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Bulletin of the Wisconsin Natural History Society

Wisconsin Natural History Society, Milwaukee Public Museum

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OF THE

Wisconsin Natural History Society

VOLUME III

(NEW SERIES)

WITH NINE PLATES

MILWAUKEE
1903—1905

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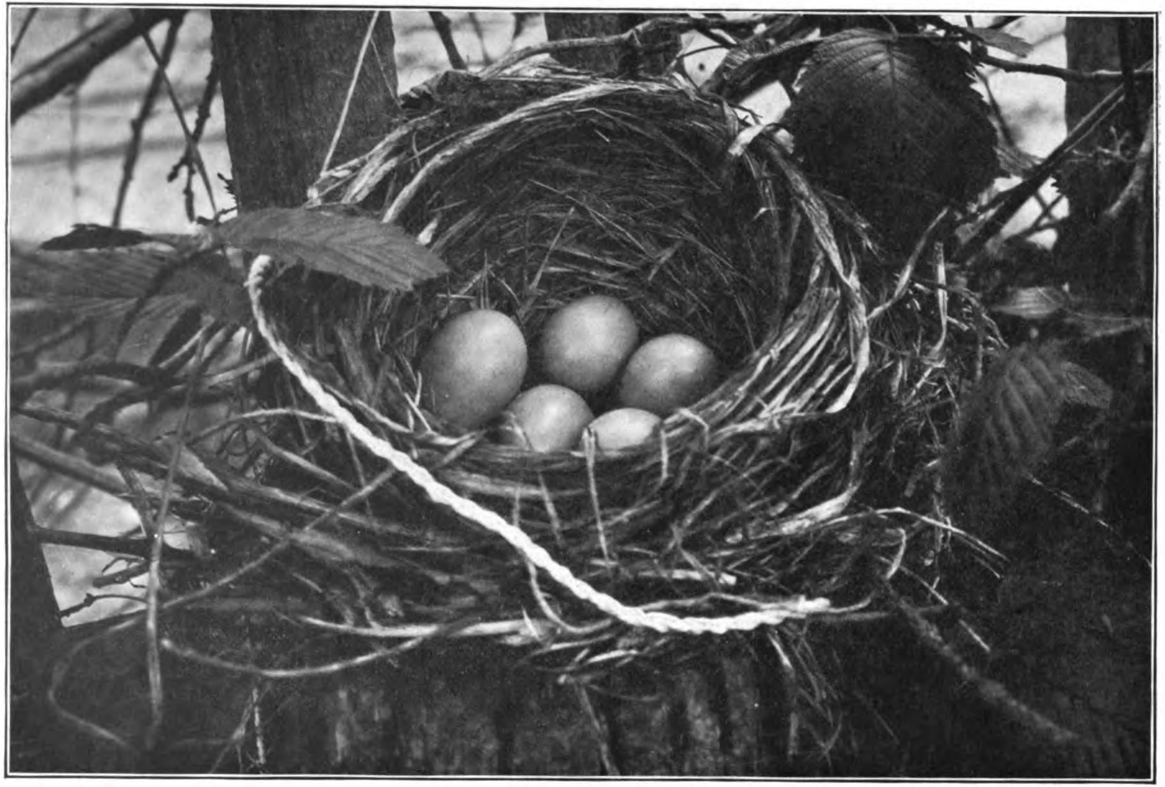

NEST AND EGGS OF AMERICAN ROBIN.

Photo. by F. E. BURROWS.

Vol. 3 (NEW SERIES) JANUARY, APRIL, JULY, 1903. Nos. 1, 2 and 3

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY

THE BIRDS OF WISCONSIN

By L. KUMLIEN and N. HOLLISTER

PUBLISHED WITH THE CO-OPERATION
OF THE
BOARD OF TRUSTEES
OF THE
MILWAUKEE PUBLIC MUSEUM.

MILWAUKEE, WISCONSIN.

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The Wisconsin Natural History Society,

MILWAUKEE, WISCONSIN.

ORGANIZED MAY 6, 1857.

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" " "	" II,	" 1,	Oct.	1902,	25 "

PUBLISHER'S NOTE.

In putting the following paper through the press the Society has been left without assistance from the authors in the correction of proof and preparation of index. Prof. Kumlien's lamented death last winter is a source of sorrow to his many friends. Mr. Hollister has been absent from the state since last May, spending the season in Alaska, where he has been engaged in investigations for the United States Biological Survey. The manuscript received the last touches from his hands early in March. The delay in publication has been due to many causes, not the least among which has been the lack of time on the part of those upon whom the duty of supervising the work of publication has fallen. The greatest pains have been taken to secure accuracy in printing. Some errors, which have been detected too late for correction are pointed out in the list of *errata* following this note.

The expense of publication has been shared by the trustees of the Milwaukee Public Museum, whose generous co-operation is hereby gratefully acknowledged.

Attention is called to the price list of the publications of the Society, printed on the preceding page.

ERRATA.

Page **52** for **Sqatarola** *read* **Squatarola.**
Page **90** for **EVENING GROSBECK** *read* **EVENING GROSBEAK.**
Page **127** for **Hylocichia** *read* **Hylocichla.**

BIRDS OF WISCONSIN.

By L. KUMLIEN and N. HOLLISTER.

PREFATORY NOTE.—The publication of the present list had been contemplated for some time before the actual work on it was begun, about two years ago. For some years past we have been as active as time from other affairs would permit in looking up records, gathering material, and working out, as best we could, those innumerable, obscure and discouraging points, which constantly multiply before one, when an attempt is made to compile an accurate and strictly reliable local list in any branch of biology. Our foremost thought during this period has been to perfect the list whenever an opportunity has presented itself, or could be found.

The result of this work has been, not to enlarge the list of birds supposed to occur within the boundaries of our state, as might reasonably be expected, but actually to reduce the number by eight species! Starting in 1899, with a list of 365 species and sub-species that had been recorded from, or were supposed to have occurred at some time within the state, the number has fallen away from time to time, until now we recognize but 357 in all, that we believe are really entitled to a place, and are therefore embraced in the list proper of the present paper.

This does not necessarily imply that no new species have been added, but rather that many species heretofore considered as belonging to the Wisconsin avifauna are found to be wholly lacking in any authentic record to prove their claim to such a place.

We have made no attempt at descriptions of birds, nor have we gone to any length in discussing their habits. Our whole aim and object has simply been to bring our knowledge of Wisconsin ornithology, as regards occurrence and abundance, up to date, and to present a carefully compiled list of all those species and sub-species which have positively been known to occur within the limits of the state at any time, with as exact, simple, reliable and accurate an account of such occurrence as possible.

THE WORK AHEAD.—Notwithstanding the vast amount of work which has been done in the state, the long period of years represented, and the pleasing results obtained, there are still many points on which the information obtainable is entirely inadequate. The ranges of many conspicuous species, as well as of rarer and more difficult sub-species, are but little known. Some of these, especially the latter, can only be worked out by the accumulation of series of specimens, migratory and breeding, from all parts of the state. Many sections, in fact, whole counties and groups of counties, have been but little worked. Some of these districts will doubtless well repay a careful observer, and furnish valuable material to throw new light on little known problems which now seem so hopelessly perplexing. That section of the state bordering upon the Mississippi River, the whole southwestern part, as well as the more northern counties, are but little known. It is not yet possible to say with certainty just what species may be found breeding in the extreme northern counties, and the western part of our area should furnish several western forms not in this list, as well as additional breeding records now hardly considered possible.

We regret that several combinations of circumstances, including, as greatest of all, the "lack of time," have obliged us to omit from the present paper several subjects of great interest which it was originally intended to include in it. These are the History of Wisconsin Ornithology, Physiography and Bibliography. Much work has already been done on these subjects, especially the latter, and it is hoped that they may at some future time be presented in another paper.

RECORDS.—We have included in the main list only those species and sub-species which we ourselves are thoroughly satisfied have, at some time, occurred in the state, and which have records *entirely satisfactory to us*. Our determinations are founded either upon specimens which we have ourselves taken in the field, or have ourselves examined in collections of others, public or private, or upon records made by others whom we have been able to accept as strictly reliable and competent ornithologists. Doubtful species have, following the usual custom, been relegated to a "Hypothetical List," at the end of this paper.

CLASSIFICATION AND NOMENCLATURE.—We have followed the arrangement of higher groups and the sequence of species of the American Ornithologists' Union Check-List of North American Birds. In the matter of nomenclature, however, although following this recognized authority in the main, we have in some cases used names not yet acted upon by the

Committee, and have used as full generic names a number of those as yet considered as of but sub-generic value in the Check List. In all but a few cases these changes have been already made in Ridgway's Birds of North and Middle America, Parts I. and II. We have used only such as seem to us to be correct and likely soon to come into general use and to be recognized by the A. O. U. Committee in time.

Sources of Information.—The records, notes, and observations herein given are based principally upon our own collections and personal work in the field, covering a large part of the time for periods of thirty-five and fifteen years, respectively. In this time work has been done, more or less thorough, over a large portion of the State. While the greater part by far of the time has been spent in the southeastern counties of Jefferson, Rock, Dane, Milwaukee, Waukesha and Walworth, trips have been made, allowing of extended observations and collections, along the entire length of the shores of Lake Michigan and Lake Superior, the Michigan border, and to different points along the Mississippi River, as well as in a goodly number of the central counties. Added to this, and perhaps of even greater value, has been the use of the extended, accurate and perfectly authentic notes of the late Thure Kumlien, covering a period of constant residence in the state of nearly forty-five years, from 1844 to 1888, making, with the time spent by us in similar work, a total period of sixty years of constant observation, embracing nearly all parts of the state and especially complete for the southeastern portion. Besides the personal acquaintance of the late Dr. P. R. Hoy and Capt. B. F. Goss, we have had the benefit of many letters from these gentlemen to Thure and L. Kumlien for many years. These letters, in many cases, have been of great value in verifying records, and have furnished valuable notes. Mr. J. N. Clark, of Meridian, Dunn County, has contributed a list of the birds noted in that section of the state during over sixteen years of active and careful work, with copious notes on such species as we have especially inquired about. The collections of the Milwaukee Public Museum and of a number of private ornithologists have been carefully gone over.

The published lists of Wisconsin birds have been of great service. Especially worthy of mention in this connection are the following: "Notes on the Ornithology of Wisconsin," by P. R. Hoy, M. D., corrected and reprinted from the Proceedings of the Academy of Natural Sciences of Philadelphia in the Transactions of the Wisconsin State Agricultural Society, Volume II, 1852, pp. 341-364; "Ornithological Fauna of Wisconsin," by Rev. A. Constantine Barry, in the Proceedings of the Boston Society of Natural History, January, 1854; "Economic Relations of Wisconsin Birds." by F. H. King, in the Geology of Wisconsin, Survey of 1873-1879, Vol. I, 1883, pp. 441-610; "On the Birds of Shiocton in Bovina, Outagamie County, Wisconsin, 1881-83," by F. L. Grundtvig (translated by Charles E. Faxon), in the Transactions of the Wisconsin Academy of Sciences, Arts and Letters, Vol. X, 1894-1895, pp. 73-158. It has also been found expedient constantly to consult Mr. E. W. Nelson's "Birds of Northeastern Illinois," Bulletin of the Essex Institute, Vol. VIII, pp. 90-155. Many valuable notes have also been found in minor lists, in Baird, Brewer and Ridgway's "History of North American Birds," and in the files of the Auk, Nidologist, Osprey, Wisconsin Naturalist, Bulletin of the Wisconsin Natural History Society, etc., etc.

ACKNOWLEDGMENTS are due to many Wisconsin ornithologists for valuable help in the preparation of the list. To Messrs. J. N. Clark, H. Russel, H. L. Skavlem, Wm. J. Bennetts, S. R. Hartwell, H. H. T. Jackson, H. A. Winkenwerder, and Drs. H. V. Ogden and E. Copeland, who have furnished notes and suggestions, or allowed us to examine their collections; to Mr. and Mrs. Wm. Henry Miller for kindly making it possible for us to inspect the Hoy collection, now in their possession; to Mr. Witmer Stone, of the Philadelphia Academy of Sciences, for various kindnesses; and especially to Mr. William Brewster, who has examined and determined many specimens for us; we wish to express our sincere thanks.

Delavan, Wis., March 7, 1903.

THE BIRDS OF WISCONSIN.

ORDER PYGOPODES: DIVING BIRDS.

FAMILY PODICIPIDÆ: GREBES.

Æchmophorus occidentalis *(Lawr.).* **WESTERN GREBE.**

One specimen in the collection of L. Kumlien, killed with a pitchfork, from a bunch of six in an air-hole in the ice on Lake Koshkonong, January 4, 1878. Another specimen formerly in the collection of Thure Kumlien, now mounted and in the collection of the Oshkosh Normal School, was taken on Lake Koshkonong, October, 1881, (1) by F. Kumlien. The former does not appear to have been sexed, the latter is a female. We are positive we have seen others, but they are very rare in Wisconsin.

Colymbus holbœllii *(Reinh.).* **HOLBŒLL'S GREBE.**

Holbœll's grebe is found sparingly in March and early April on most of the larger inland lakes and rivers, as well as on Lake Michigan, and again from September, but more often from October, until the ice forms. Where there is open water, both on Lake Michigan and in the interior, many remain all winter. There is some obscurity in regard to the larger grebes in Wisconsin, and this without perpetuating the error of retaining *cristatus*. We are obliged to discard some of the early day records for the reason that the nomenclature has been so muddled that it cannot, with certainty, be unravelled. We have seen a young grebe, less than half grown, taken near the City of Green Bay, which is in all probability this species. There is no doubt that *some* large grebe nests, or did nest, rarely in Northern Wisconsin, and it seems not at all unlikely that it is *holbœllii*.

Colymbus auritus *Linn.* **HORNED GREBE.**

Still fairly common as a spring and autumn migrant. Not infrequently nests in the northern part of the state, as it

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1. Not 1891, as labeled.

formerly did even in the southern tier of counties. Young a few days old were procured at Lake Koshkonong during June, 1880. Few of our birds have suffered more from the depredations of the plume hunter, than has this species.

Colymbus nigricollis californicus *(Heerm.)*. **AMERICAN EARED GREBE.**

Very rare in Wisconsin. We have received two spring specimens from near Iron River, Bayfield County, but have never personally come upon or taken one in Wisconsin. Mr. H. A. Winkenwerder, of Watertown, Wis., has sent us a wing of this species, which is said to have come from a bird shot at that place. We suspect the bird to be a rather rare migrant in the western part of the state, and possibly to breed in small numbers in the extreme northwestern portion. Mr. E. W. Nelson, in 1876, says of this species (1): "Not uncommon in winter upon Lake Michigan." This is certainly good authority, but entirely contrary to our observation.

Podilymbus podiceps *(Linn.)*. **PIED-BILLED GREBE.**

A common summer resident in all suitable localities. It arrives in southern Wisconsin early in April, if an average season, and remains until the ice forms, usually in November. Apparently has not decreased in numbers during the past forty years.

FAMILY GAVIIDÆ: LOONS.

Gavia imber *(Gunn.)*. **LOON.**

This loon may be found on Wisconsin waters almost any month of the year, and during March and April is a common migrant on all inland lakes and streams. In autumn it is less common inland, but occurs plentifully on Lake Michigan and the Mississippi River. A number remain all winter on Lake Michigan. It was formerly a common breeder on the small lakes from the southern tier of counties northward. Thirty years ago it bred on Lake Koshkonong and many other small lakes where it now occurs only during the migrations. A few nested at Delavan lake up to 1888, and possibly a straggling pair now and then for a few years later. Farther north, where the country is less thickly settled, many still breed. Extremely variable in size, there being a range of variation of from six to

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1. "Birds of Northeastern Illinois"; Bulletin of the Essex Institute VIII, p. 150.

eight inches in length. There is no record of *G. adamsii,* but in 1860, Thure Kumlien received a spring loon which had a pale bill, nearly white at tip, gradually fading into a dull straw yellow, and nearly normal at the base. In no other respect, however, he states in his notes, did it differ from typical *imber.*

Gavia arctica *(Linn.).* **BLACK-THROATED LOON.**

This is certainly a very rare bird in Wisconsin, occurring only as a straggler in late fall or winter. We have access to but three unquestionable records. One was shot on Rock River, near Janesville, late in the winter of 1860, and mounted for the owner, a gentleman from Rockford, Ill. This was an immature specimen, still showing many traces of the winter plumage. Another, taken at Racine, was preserved in the Hoy collection; and another, taken at Milwaukee, is also on record.

Gavia lumme *(Gunn.).* **RED-THROATED LOON.**

"Very common winter resident upon Lake Michigan" (Nelson, 1877). "Not uncommon during winter" (Hoy, 1852). From my own observations I find this species a regular and common resident of Lake Michigan in winter. During the unusually severe winter of 1880-81, when Lake Michigan at Milwaukee was frozen nearly or quite across in places, large numbers of this species were seen off that city, and many were caught. They could be seen huddled together on the ice, some dead and others nearly famished. Such as survived until spring were uncommonly tardy in their northward migration, especially as the spring was unusually backward. The following June (1881) I saw a dozen or more on the rocks at the "Door" (the extreme northern end of Door County, between Lake Michigan and Green Bay), and coupling this with a quantity of second-hand information, made a record to the effect that they were breeding. Possibly they were, but with the mature judgment of later years I should have been much slower in considering the evidence conclusive. Many, if not all, of the birds were in full summer plumage, but I have since learned on more than one occasion, that the presence of birds in a given locality in summer is not evidence that they are nesting (L. K.). On the larger inland lakes and streams the red-throated loon is seldom seen in spring, but occurs sparingly during October and November, or until the ice forms. Specimens in full plumage are rarely taken in Wisconsin.

FAMILY ALCIDÆ: AUKS, MURRES AND PUFFINS.

Synthliboramphus antiquus *(Gmel.).* **ANCIENT MURRELET.**

A single specimen of this species was shot in October, 1882, on Lake Koshkonong, by Rev. G. E. Gordon, of Milwaukee. Its occurrence there was, of course, purely accidental. As the opportunity occurs we will here correct one of the numerous errors in that most unfortunate bulletin, "The Birds of Michigan," by A. J. Cook, where other specimens of this species are accredited to Wisconsin as having been taken by us (1). This is an utterly unaccountable error. The bird taken by Mr. Gordon and noted in the Auk of January, 1884, by Mr. Geo. B. Sennett, is unquestionably the only Wisconsin record.

ORDER LONGIPENNES: LONG-WINGED SWIMMERS.

FAMILY STERCORARIIDÆ: SKUAS AND JAEGERS.

Stercorarius pomarinus *(Temm.)* **POMARINE JAEGER.**

Rare winter visitor on Lake Michigan. Early in October, 1879, we saw three specimens of this jaeger on Green Bay. They were close about the boat while the fishermen were emptying their nets, and we had the opportunity of watching them for an hour or more. A week later we had a letter from Thure Kumlien, at Lake Koshkonong, informing us that he had secured one specimen from a group of three that had visited the lake. Another was secured later in the fall by a hunter and mounted for him. We have positively seen this bird on several occasions on Lake Michigan late in the fall. It is recorded by Nelson from Evanston and Chicago.

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1. Where Mr. Cook obtained all these records, I am unable to say. Mr. Gordon's bird was sent to Milwaukee to be mounted; a friend called my attention to it, and as the taxidermist's chief interest in the bird was to get his pay for the mounting, I induced him to let me take it. I made a colored drawing and sent it to Prof. Ridgway. In the meantime the owner called for his bird and I had to give it up. My notice prepared for the Auk did not reach the editors until after the late Mr. Sennett's article. From this information Mr. Cook may have made his unfortunate blunder.—L. K.

FAMILY LARIDÆ: GULLS AND TERNS.

Larus glaucus *Brünn.* **GLAUCOUS GULL.**

Rare winter visitant on Lake Michigan. Dr. Hoy obtained three specimens at Racine (1) and saw others during severe winters. In the Milwaukee Public Museum are three specimens procured at Milwaukee, January 8, 12 and 14, 1895. We are positive of having seen this species on several occasions during winter while engaged in Fish Commission work on Lake Michigan. One large specimen was caught on a herring-baited hook, but was washed overboard and lost. There is difficulty in discriminating between this species and the next, so it is impossible to say which occurs most frequently, but we are inclined to think that *leucopterus* is much more often seen.

Larus leucopterus *Faber.* **ICELAND GULL.**

A regular winter visitant on Lake Michigan, but by no means common, although occuring more frequently than *glaucus*. We know of no record for the interior.

Larus marinus *Linn.* **GREAT BLACK-BACKED GULL.**

We have seen this well-marked species on Lake Michigan, at the Milwaukee light house, mid-winter 1880-1, and on at least two occasions out on the lake. It is, however, rare. According to Nelson, not an uncommon winter resident upon Lake Michigan. Also recorded in Ridgway's List of Birds of Illinois (1874), on the authority of Dr. Velie, of Chicago. Given as common at Racine by Rev. A. Constantine Barry (2), but Dr. Hoy's list of 1852 does not include it, although his observations were made at about the same time and at the same place. Dr. Hoy admitted the species, however, at a later date. A specimen mounted for the Oshkosh Normal School was labeled "Lake Michigan."

Larus argentatus *Brünn.* **HERRING GULL.**

Very common on Lake Michigan at almost all seasons, and a common migrant on all suitable waters of the state. Nests commonly on different islands of Green Bay, and on the north shore of Lake Michigan. Immature birds, not breeding, may be found on any of the larger inland lakes during the summer. Remains throughout the winter wherever there is open water, and is especially frequent at this season about the larger harbors. Not nearly as numerous as formerly.

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1. Nelson, Birds N. E. Ill.
2. Ornithological Fauna of Wis., Proc. Boston Soc. Nat. His. Jan. 1854.

Larus delawarensis *Ord.* **RING-BILLED GULL.**

A common migrant, spring and fall, but does not occur in such numbers as the preceding. It is commonly met late in November, and during mild winters still later, but the majority seem to move further south on the approach of severe weather. Large numbers pass up and down the Mississippi River in the spring and fall. Formerly bred on Spider and Strawberry Islands, Green Bay, from which localities we have eggs (L. K., 1879-81-82). In 1860 it bred as far south as Lake Koshkonong, as at least one instance was recorded by T. Kumlien—a nest of three eggs in a marsh among the black terns. Immature birds are found all summer at the fishing stations and larger harbors, as well as on the inland lakes and larger streams.

Larus atricilla *Linn.* **LAUGHING GULL.**

The only known Wisconsin record for this species is that of Thure Kumlien, who shot a single specimen on Lake Koshkonong in July, 1860 (1). We find that Cook's "Birds of Michigan," 1893, says: "Very abundant on the Great Lakes; probably breeds in the northern peninsula (Gibbs' Birds of Michigan)." If this is correctly quoted it is surely a gross error. The same list, quoting Dr. A. K. Fisher, says: "Very rare north, if it occurs at all," and states that L. Kumlien says it is "fairly common" (2). Inasmuch as we seriously doubt that the bird ever visits Lake Michigan, except perhaps as an accidental straggler, the absurdity of the latter mis-quotation is apparent.

Larus franklinii *Sw. and Rich.* **FRANKLIN'S GULL.**

Not common, but of regular occurrence in the eastern part of the state as a fall migrant, from September until the small lakes and rivers are closed by ice. There are but two records of its capture in Walworth County, but it is taken yearly on Lake Koshkonong in September and October. Near Rockdale, Dane County, it was noted in considerable numbers following the teams that were plowing on the prairie in May, 1870. This is the only appearance of the spring birds we have ever noted in eastern or central Wisconsin. Mr. J. N. Clark reports it in September, in Dunn County, and along the Mississippi it is not at all rare. On Lake Michigan it is less

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1. B., B. and R., N. A. Birds, Vol. II. p. 257.
2. Very few have had the opportunity for observing the gulls on Lake Michigan that we have had, and we have never seen a specimen of *Larus atricilla* here.—L. K.

common than anywhere in the interior, and Dr. Hoy, in 1852, says: "Visits us only in severe winters. Rare." It is easy to see how the doctor came to make this statement, as the bird is not a lake gull or a winter resident, and the only birds he met at Racine were late stragglers, and he supposed them to occur at this season only. It seems remarkable that so few spring specimens are obtained in eastern Wisconsin. In fact, birds in breeding plumage are, except along the Mississippi, decidedly rare in the state.

Larus philadelphia *(Ord.).* **BONAPARTE'S GULL.**

The systematic slaughter of this beautiful gull for millinery purposes has so reduced its numbers that we can no longer claim it as our most abundant species. We are informed on good authority that for several seasons, in May, between 1880 and 1888, two men from Chicago regularly visited Lake Koshkonong to shoot this gull for its plumage. Report says "thousands" were killed, and that when the gulls left for more northern waters the plume hunters followed—how far we know not. These men reported that there were many others employed, and they visited such lakes as the gulls frequented in numbers each season. From about 1865 to 1875 it was a sight worth seeing when hundreds, perhaps thousands, of these birds commenced to flock together on Lake Koshkonong, and with one accord began their circling flight northward. These vast flocks passed directly over our house as they left the lake, and many a time have we watched them, rising higher and higher, and gradually fading from view. In the same locality at the present day very few are seen, either in spring or fall, although small flocks are of regular occurrence on any of the larger lakes. In 1880 a few were said to breed on Chambers' Island, Green Bay, and we saw on some small islands in Big Bay de Noquet, Michigan, a number of nests like pigeons nests on the flat branches of low coniferous trees that without question had been used by these birds. Many full-plumaged birds were seen and numbers of young, but only one so young as to be still unable to fly. When this species was common, from 1865 to 1880, it generally put in an appearance in southern Wisconsin during the first week of April, remaining to or past the middle of May. Immature birds remained the entire summer. The fall migration began sometimes as early as the middle of August and a few remained until the ice formed. A few remain until mid-winter, especially on Lake Michigan, but as a rule it is not a winter resident.

Xema sabinii *(Sab.).* **SABINE'S GULL.**

A young male was shot on Delavan Lake, Walworth County, October 7, 1900, by Mr. H. P. Hare, and is now preserved in the collection of N. Hollister. This is probably the only authenticated Wisconsin specimen extant. Dr. Hoy reported it as having been seen by him at Racine in November, 1853. Mr. E. W. Nelson is also positive of having shot a specimen on the shore of Lake Michigan, near Chicago, the first of April, 1873, but the bird was blown out into the lake and lost. In April, 1897, we examined and identified two fresh wings of this species, brought to a taxidermist in Janesville to be prepared for a hat. This bird was killed on Rock River, near that city.

Sterna caspia *Pall.* **CASPIAN TERN.**

Not common, except, perhaps, on northern Lake Michigan and Green Bay. Breeds, or did in 1879-80-81-84, and 1893, on different islands in Green Bay and on the north shore. Frequently found on Lake Michigan in winter. Visits irregularly the larger inland lakes. A large flock appeared on Lake Koshkonong, May 29, 1896, from which fine specimens were shot by L. K. Also noted on Lake Koshkonong a number of times during the summer. Not noted by Hoy in his list of 1852, and consequently not found in King's list of 1879, the latter being chiefly a compilation from Hoy.

Sterna forsteri *Nutt.* **FORSTER'S TERN.**

A common migrant during the first two or three weeks of May, and again from September until the middle of October; and still later on Lake Michigan. Such birds as breed in the state often scatter after the nesting season, and both old and young are often found in August. Not nearly as numerous as formerly. Although the larger part are migratory a good many still nest within the state, principally in the small reedy lakes, even in the southern counties. In June, 1872, a large number, not less than two hundred pairs, nested at Lake Koshkonong. The nests were mostly roughly heaped up masses of the dead stems of the cane (*Phragmites phragmites*), placed close together, often a dozen or more in a cluster, and situated in the more open spaces among the year's growth of the cane. Plenty as were the nests and eggs, still we had the greatest difficulty in getting even two or three positively identified sets, as the discovery was soon made that all were not *forsteri*, but many *hirundo*, and a few *paradisæa*. As the day was warm with bright sunshine the birds did not stay on their nests, but the entire colony was constantly hovering over us. It was only toward night, as a bird would settle on its nest and could be shot as it arose that we succeeded in identifying and procuring a few sets of *forsteri* and *hirundo*. A second visit to the colony a week later was of even more interest, for then the nestlings were out in force; but it was utterly impossible to distinguish them. As far as our observation goes *forsteri* prefers the small reedy, inland lakes for breeding purposes, while *hirundo* is more often found on the islands of Lake Michigan and Green Bay.

Sterna hirundo *Linn.* **COMMON TERN.**

Formerly, at least up to 1880, a very common migrant, at about the same dates as the preceding. More common on Lake Michigan than *forsteri*, and more abundant here than in the interior of the state, preferring the gravelly or sandy islands of the lake and Green Bay for nesting places, rather than the smaller inland lakes. Very greatly diminished in numbers during the last quarter of a century.

Sterna paradisæa *Brünn.* **ARCTIC TERN.**

A somewhat irregular migrant, at times fairly common, and again quite the opposite. We have taken it nesting in Green Bay, 1879, and in June, 1891, procured a set of eggs—the parent shot on the nest—at Lake Koshkonong. These nesting records are, however, to be considered as exceptional. May 27, 1899, Mr. H. H. T. Jackson, of Milton, found a dead specimen of this species, partly devoured by some animal, on a muskrat house in a small lake half a mile from Milton. This bird proved to be a female and contained two nearly perfect eggs. Less common in the fall than in the spring, less often met inland in the fall than the two preceding, and not as abundant as either at any time or place in the state, this species was evidently entirely overlooked by Dr. Hoy, Rev. Mr. Barry and others, as it was for many years by Thure Kumlien. It arrives a little earlier in the spring than either *forsteri* or *hirundo*. It is readily distinguished from either of these by its smaller, redder bill and *much* darker underparts.

Sterna antillarum *(Less.)*. **LEAST TERN.**

This species can be considered only as a very rare summer visitor from the south. In June, 1893, three full-plumaged birds were shot by L. Kumlien at Black Hawk Island, Lake Koshkonong, among a large colony of black terns. Another specimen is, or was, preserved in a store in Janesville, said to have been shot on Rock River near that city. There is also one Milwaukee record of which we are sure, but we are unable to find the date. Rev. A. Constantine Barry, in his list of 1854, says: "Not so common as the black tern and probably does not breed in the state." Not included in Hoy's list of 1852.

Hydrochelidon nigra surinamensis *(Gmel.).* **BLACK TERN.**

A very common summer resident in all the inland ponds, sloughs, wet marshes and lakes, but seldom found on Lake Michigan, and probably only during migrations. Arrives in Wisconsin, of an average year, the first few days of May—dates of arrival for a number of years at Lake Koshkonong range from April 16 to May 11—and departs early, few being seen after the middle of September. When they arrive in the spring all are in the black, full breeding plumage; and all are in the white winter plumage before they leave; in fact, a great many begin to assume their winter plumage before they are through nesting. Not as plenty as formerly, still their numbers have not decreased anything like those of the common or Forster's Tern.

Hydrochelidon leucoptera *(Meisn. and Schinz).* **WHITE-WINGED BLACK TERN.**

The only known instance of the occurrence of this species on the western continent is that of a breeding female shot by L. Kumlien in a large marsh near Black Hawk Island, Lake Koshkonong, July 5, 1873. The specimen was sent freshly skinned to Dr. Brewer and was presented by him to the National Museum. The partially denuded abdomen and well formed ova prove that it would have bred—whether with its own kind or with the common species we know not, as no others were seen at the time nor since, although days have been spent in the tern colonies for almost no other purpose than the vain hope of seeing more of them. The bird was quite noticeable among the enormous numbers of black terns—so much so that there is no special need for any one to sacrifice the life of any of the common species under the delusion that it may prove to be *leucoptera* when in hand.

ORDER STEGANOPODES: TOTIPALMATE SWIMMERS.

FAMILY PHALACROCORACIDÆ: CORMORANTS.

Phalacrocorax dilophus *(Swain.).* **DOUBLE-CRESTED CORMORANT.**

Twenty-five to thirty years ago this was a common migrant in suitable waters throughout the state. It arrived as soon as the ice began to loosen in the small lakes, varying with the season from early in March until April, and remained until May first. Even when it was more common, comparatively few were noticed in the interior during the fall, although more plenty on the Mississippi River. Mr. J. N. Clark, writing from Dunn County, reports small flocks along the Chippewa River in spring, but considers them rare there. A few, we think, remain on Lake Michigan during mild winters. During the past five years the cormorant has been more plenty than for many years previous in Walworth County, and doubtless at other suitable places on the line of flight, both in the spring and in the fall. A few used to remain on Lake Koshkonong all summer, but we have never found them nesting, as they probably do in certain counties of the northern part of the state. Mr. Chas. F. Carr (1), now of New London, Wisconsin, is authority for the statement that "they breed about some of the larger, isolated lakes in the northern and central part of the state," and "feed at a considerable distance from the vicinity of their nesting haunts, and when leaving and returning fly at a great height."

FAMILY PELECANIDÆ: PELICANS.

Pelecanus erythrorhynchos *Gmel.* **AMERICAN WHITE PELICAN.**

This once abundant species is now chiefly found along the Mississippi River during spring migrations. In past years we have observed great flocks of them on Lake Koshkonong in April, and often well into May, and we never tired of watching them swim up some bay, and forming a line across, slowly move toward the shore, nearly every bird with head and neck under water. When a fish was captured the head was raised until the bill was nearly vertical, and the fish, or as much of it as there was room for, swallowed. At these times they were

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1. **Wis. Naturalist, I-2, Sep. 1890.**

anything but shy, and were, in fact, easily approached. During the past ten years we know of but one specimen having been taken on Lake Koshkonong, a juvenile, in July, 1892, and only one small flock seen. Two or three were killed on Duck Lake, Walworth County, about 1888, three seen on Delavan Lake June 6, 1895, and one specimen, a single female, was shot in the inlet of Delavan Lake, September 4, 1898, which is now in the collection of N. H. Mr. J. N. Clark reports but two instances of the occurrence of pelicans in Dunn County during many years' observations, these in 1891, and considers them very rare there. In 1883 we visited abandoned rookeries in the western part of the State, and we are reliably informed that a very few nested northeast of Merrill in 1884. Probably few, if any, nest in the state at the present time; in fact this is fast becoming one of our rarer birds. Did not seem to frequent Lake Michigan to any extent even when common inland.

FAMILY FREGATIDÆ: MAN-O'-WAR BIRDS.

Fregata aquila *Linn.* **MAN-O'-WAR BIRD.**

A single straggler of this species was shot in the Milwaukee river, at Humboldt, near the city of Milwaukee, in August, 1880. The bird was sitting on a rock projecting out of the shallow water, and was shot by a boy with a pistol. The specimen is now mounted in the Milwaukee Public Museum.

ORDER ANSERES: LAMELLIROSTRAL SWIMMERS.

FAMILY ANATIDÆ: DUCKS, GEESE, AND SWANS.

Merganser americanus *(Cass.).* **AMERICAN MERGANSER.**

Common as a migrant, arriving in the spring as soon as there is any open water — in fact, a few remain all winter wherever it is not frozen, about spring fed creeks. Said to nest on the extreme northern end of Door County. We have seen them in this locality in summer and also at different places on the south shore of Lake Superior in July and August. Fully as common as thirty years ago.

Merganser serrator *(Linn.)*. **RED-BREASTED MERGANSER.**

Common during migrations, but not in as great numbers as the preceding. A regular breeder about Green Bay and Lake Superior. We have nesting records for Green Bay up to June, 1886. Our observation has been that it is much more common in the eastern than in the western part of the state, and is not as liable to remain all winter as is *M. americanus*.

Lophodytes cucullatus *(Linn.)*. **HOODED MERGANSER.**

Very common, sometimes fairly abundant, in most sections of the state, although for some reason not apparent it does not frequent all sections alike. Where there is open water, as in Lake Michigan, and, in mild winters, portions of the larger inland lakes, it remains all winter. Breeds sparingly, in suitable localities, from the southern tier of counties northward. Unlike the last two this "fish duck" is most often of excellent flavor, and is considered by many local gunners as superior to the blue-bill, whistler, butterball, and many other sea ducks.

Anas boschas *Linn.* **MALLARD.**

Still abundant as a migrant, and, in Southern Wisconsin, as a winter resident. Here large numbers remain on the prairies all winter, feeding in the corn fields and resorting to the open springs and spring runs at night. At the present time the mallard nests but sparingly in the localities where it was formerly a common breeder, still clinging, however, to any suitable locality when not too much disturbed in late spring.

Anas obscura *Gmel.* **BLACK DUCK.**

Typical *obscura* is rather rare in Wisconsin. A few are found during the spring migrations, and some nest each year throughout the interior of the state, where they are much more common than on Lake Michigan. We have shot young, not yet able to fly, in Green Bay in August, presumably of this race, and a limited number formerly nested in Horicon Marsh. About Delavan specimens are sometimes taken on tne opening day of the ducking season, September 1, when it is still very hot and unlikely that any migration has commenced.

Anas obscura rubripes *Brewst.* **RED-LEGGED BLACK DUCK.**

This is the common form of the "black mallard" which is shot in Wisconsin during the fall flight and, in the southern counties, throughout the entire winter. Mr. Brewster has kindly examined five selected specimens, taken during winter and early spring at Delavan and about Milton, and pronounces four of them typical *rubripes* and one intermediate. Usually found in company with large flocks of mallards which frequent the prairie cornfields and open spring-holes during the winter.

Chaulelasmus streperus *(Linn.)*. **GADWALL.**

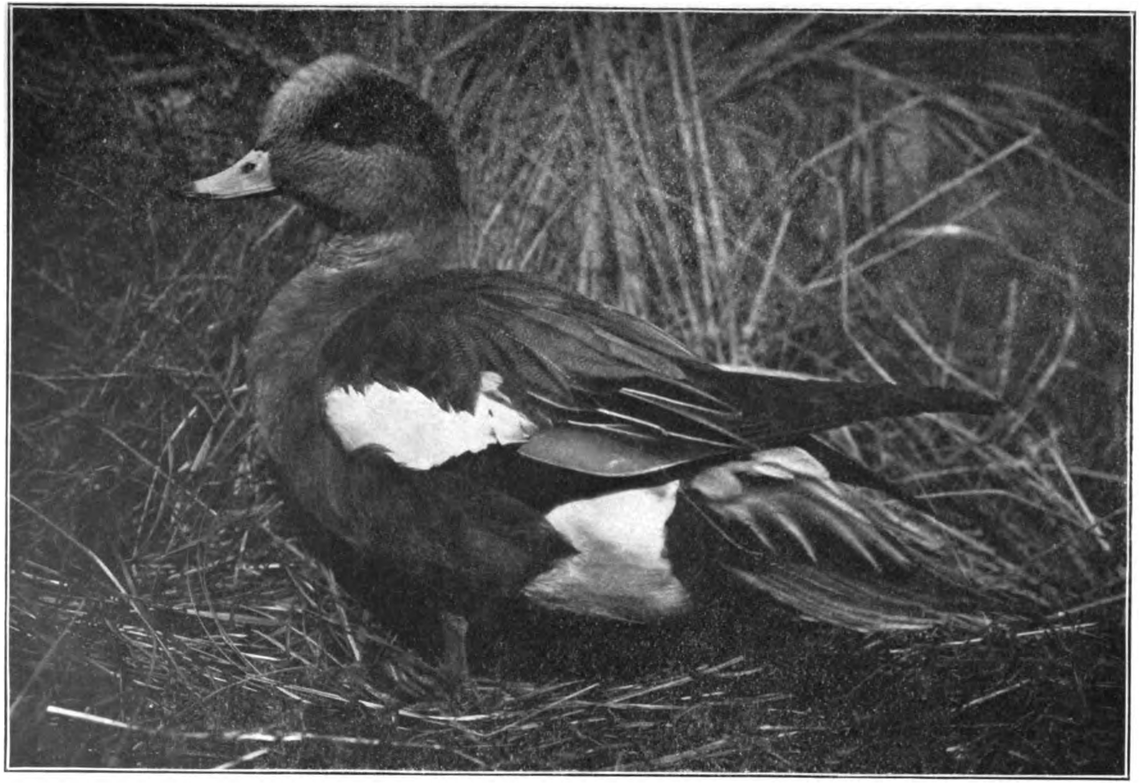
Found principally as a migrant during April and October. Not nearly as common as formerly, in fact, at the present time, not at all common. Known to nest sparingly near Lake Koshkonong twenty-five or more years ago. Capt. Goss found it breeding in Horicon Lake (now Horicon Marsh). Mr. C. F. Carr records it as breeding in the extreme northern part of the state. "Gray widgeon" of the gunners of Southern Wisconsin, when distinguished at all from the baldpate or pintail.

Mareca penelope *(Linn.)*. **WIDGEON.**

A specimen of this species was purchased, fresh killed, from a gunner on Lake Mendota in 1874, and one was shot on Lake Koshkonong in 1875 by L. Kumlein. These birds were both adult males. Another adult male was mounted in 1877 by Thure Kumlien for some sportsman, this specimen having also been shot on Lake Koshkonong. An immature male was also seen in a hunter's string of ducks as he boarded the train at Milton Junction, after a few days shooting on Koshkonong. Besides the above there are other records for the state about which there is no doubt.

Mareca americana *(Gmel.)*. **BALDPATE.**

Common migrant, spring and fall, but like most of our ducks, in constantly decreasing numbers. Formerly bred sparingly as far south as Lake Koshkonong, Horicon Marsh, etc., now in the less settled portions of the state only. Small flocks of a dozen or more immature males, that do not breed, are found on most of the larger inland lakes all summer. This species is to a considerable extent a parasite of the canvas-back, allowing the latter to dive and bring to the surface a bill full of *Naiadaceae*, and gobbling up the nutlets before the rightful owner can get at them. Known to all the hunters as the "widgeon" or "bald widgeon."



BALDPATE DUCK (Male.)

Photo. *from Life by* F. E. BURROWS.

Nettion carolinensis *(Gmel.).* **GREEN-WINGED TEAL.**

An abundant migrant in the spring and fall. As with other ducks, the dates of migration depend entirely on the weather and breaking up or forming of the ice. Of an average season the green-wing arrives early in April, although March records are not infrequent, and large numbers may be found close on to May 1. In fall the majority do not arrive on their southward journey until from the 15th to 30th of September or well into October, and remain in localities where food is plenty until very cold weather. Formerly bred sparingly even in southern Wisconsin, eggs having been taken on Black Hawk Island, Lake Koshkonong, by L. K. in May 1870. At least two other authentic nesting records at this place are known. Farther north they breed more plentifully, but the larger number pass beyond our borders for the summer.

Querquedula discors *(Linn.).* **BLUE-WINGED TEAL.**

Formerly one of the most abundant of our ducks, but of late years it has greatly diminished in numbers, perhaps more than any other species, although it is at times still plentiful during late spring and early fall migrations. Arrives much later than the green-wing, and leaves again much earlier in the autumn. Used to nest abundantly in all suitable localities in southern Wisconsin. Thirty years ago a blue-winged teal's nest was such a common affair that we seldom stopped even to find the nest when we flushed the duck. Along every grassy stream or ditch, and in all marshes and meadows and even, at times, in grain fields at considerable distances from water, it nested in abundance. A few still summer with us and breed, but it is a mere fraction of what there used to be. Naturally the most unsuspicious of all our ducks, in localities where it was not disturbed it became so tame as to allow a person to approach within a few feet, especially during the spring months.

Querquedula cyanoptera *(Vieill.).* **CINNAMON TEAL.**

A single specimen of this species was taken by a hunter on Lake Koshkonong, October 18, 1879, and mounted by Thure Kumlien. An immature plumaged male was seen by L. K. in a hunter's string of ducks at Lake Koshkonong, October 9, 1891. The owner flatly refused to part with this bird for any consideration after he found it was not the common teal, although he had not noticed any difference before. There is no doubt but that this species occurs occasionally now. There are several more or less authentic records among well informed sportsmen in different parts of the state, and at club houses on Lake Koshkonong.

Spatula clypeata *(Linn.).* **SHOVELLER.**

This species does not seem to have decreased in numbers during the past thirty-five years to the same extent that most of the other ducks have. It is still a common duck, but can hardly be called abundant, as it does not occur in such great numbers as many others do. Arrives in southern Wisconsin about the first of April, and many remain until the ice closes the small lakes and streams in late fall, but it is most abundant during October. Essentially a duck of the large marshes and shallow lakes, in these localities considerable numbers still nest within the state, even to the most southern counties. It is exceedingly variable in plumage, and the males probably do not acquire the full dress until they are at least three years old. Anything like a complete series of the plumage changes of this bird would require not less than twenty or more individuals. A remarkable specimen was secured by L. K. in May, 1870, an adult female, just about to deposit eggs, with the breast and, in fact, all the lower parts from the neck down colored like a spring male; the wings also showed an approach to the color pattern of the male. Otherwise the plumage was as in the normal female. We have noticed a tendency this way on one or two occasions before with other ducks. A most excellent table bird.

Dafila acuta *(Linn.).* **PINTAIL.**

An abundant migrant. A few still nest within the state, but they are being gradually pushed farther and farther north for the summer season. This is one of the ducks that have slowly changed their habits, until now it can be classed as a winter resident in many localities in southern Wisconsin. Wherever there are extensive corn fields, not too far from open spring-brooks, these ducks remain all winter. The pintail is most numerous in March and early April in pond holes and on large fields, and again in October on the lakes and large marshes.

Aix sponsa *(Linn.).* **WOOD DUCK.**

Formerly a very common summer resident in all heavily wooded regions about streams. At the present time more common during the migrations, spring and fall, but in much smaller numbers than thirty years ago. Grundtvig (1) gave it as "by far the most common duck at Shiocton," Outagamie County, in 1882-83, breeding "abundantly in the old maples near the river." Considerable numbers still nest in favorable localities in the central and northern part of the state, and in a few places in southern Wisconsin, as about Delavan Lake. Mr. J. N. Clark writes us that it nests regularly in Dunn County. It arrives from the first of April to the first of May, and a few remain into November, but the greater number move southward after it begins to grow cold in October. In fall it resorts to the great wild rice marshes, and while the rice lasts that seems to be its principal food. Later it takes to the oak groves about the streams and lakes, and seems to be especially partial to the acorns of the burr oak. These it eats in large quantities. It often nests considerable distances from water. We know of one instance where it bred regularly for a number of years in a very large hickory. This tree was over two miles from the nearest water in a direct line. One of our most omnivorous ducks, and, contrary to the opinions of many people, should not rank very high as a table bird.

Aythya americana *(Eyt.).* **REDHEAD.**

Arrives in Wisconsin usually with the breaking up of the ice in the smaller lakes, and returns in numbers in October, remaining until the ice again forms. This and the following species show more partiality to certain localities than others of the genus. It has been greatly reduced in numbers of late years, more so than most ducks. Formerly very abundant, it is disappearing at an alarming rate. In the fall this duck is nearly, if not fully, equal to the canvas-back in flavor, and as it commands a high price in the market, is persistently and systematically hunted and shipped to the larger cities despite the law. Has been known to breed at Pewaukee (N. S. Goss) and in Brown County (C. F. Carr). Formerly bred at Lake Koshkonong, and even at the present day a few pairs nest annually in the large marshes about the lake. The principal food of this species in the localities where it resorts in numbers during the autumn is composed of the gemmæ or nutlets of one or more species of the pond-weed family, which is also the chief food of the canvas-back when it returns in the fall.

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1. On the Birds of Shiocton in Bovina, Outagamie County, Wisconsin, 1881-83. Translated by Chas. E. Faxon. Trans. Wis. Acad. Sci., Arts, and Let. X, p. 97-1895.

Aythya vallisneria *(Wils.)*. **CANVAS-BACK.**

Common migrant. Thirty to forty years ago this duck was supposed to remain only a few days in early spring and October in favored localities where the so-called "wild celery" grew in abundance. Such localities were apparently not numerous, and the species was rated as one of exceedingly irregular distribution. During the past twenty-five years it has become more universally distributed over the state, and locally, at least, not greatly diminished in numbers. We have known for a number of years that the so-called "celery buds" with which these and other ducks are actually crammed to the bill, was no part of the plant *Vallisneria spiralis*, but still we were unable to determine what it was. What little we do know in this connection is due principally to the careful observations of Mr. H. L. Skavlem, of Janesville. Mr. Skavlem took the "buds" from the œsophagus of freshly killed specimens of the canvas-back, and keeping them in water in the cellar through the winter, succeeded in growing the entire plant the next season. This plant proved to be one of the pond-weed family (*Naiadaceae*), of which there are numerous species in the northern states. These gemmæ, or nutlets comprise the great bulk of the food of this duck in October and November in Wisconsin. In shape they are spindle form, from one-half to one inch or more in length, of a whitish color and highly farinaceous. The pond-weed grows very luxuriantly in Lake Koshkonong and other waters of the state. Where the "celery" (*Vallisneria spiralis*) grows in abundance they no doubt eat parts of it, but this condition does not obtain in quantities sufficient to furnish food enough to tempt the ducks to remain. The unusually hot, dry summer of 1901 made the shallow water of Lake Koshkonong almost hot, and the pond-weed, as well as other aquatic plants suffered greatly, so that the nutlets were smaller than usual and much fewer in number. As a consequence the ducks remained a much shorter period than usual. It is our opinion, in which Mr. Skavlem concurs, that this particular pond-weed is found in greater abundance than formerly. It also grows in shallower water than the *Vallisneria*, often even inside the belt of rushes. There is not a shadow of doubt but that the bulk of the canvas-back's food consists of the nutlets of this plant at the present day, but has anyone noted any difference in the flavor of the flesh? A number of crippled birds remain on Lake Koshkonong through the summer, and we know of three instances of females being seen with nestlings, but incline to the opinion that the birds were winged and could not continue the journey northward. In December, 1877, some farmers who were digging the decayed vegetable matter, known locally as "muck," for fertilizer, exhumed in a small bay on Lake Koshkonong, a beautiful specimen in the condition known as adipocere. With the exception of the feathers, every part, even to the intestines, was perfectly preserved, and had the appearance of meerschaum. Several shot holes are plainly noticeable on the breast and abdomen, and one shot is imbedded in the sterum. The specimen is now in the collection of Milton College.

Aythya marila *(Linn.).* **SCAUP DUCK.**

Migrant. Of regular, but far from common occurrence on all the larger water courses of the state, frequenting most plentifully the deeper lakes and large rivers. Arrives earlier in spring and departs later in fall than either of the other "blue-bills." We have no evidence that leads us to suspect that this species ever breeds in the state. More common on Lake Michigan. We have seen large numbers of these birds, with a few of *affinis* and *collaris* in the Milwaukee market, all killed on the lake, and we suspect this is the common form which winters on Lake Michigan. More common inland in fall than spring.

Aythya affinis *(Eyt.).* **LESSER SCAUP DUCK.**

An exceedingly abundant migrant, both spring and fall. Probably the most abundant duck in Wisconsin, arriving with the breaking up of the ice and remaining in the fall until well into December, or until every lake is frozen over. To a limited extent a breeding species even in southern Wisconsin, having been known to nest anywhere from the southern counties northward, but as with most of our ducks and waders by far the great majority pass beyond our borders to nest. On every lake of any size, Winnebago, Koshkonong, Delavan, etc., numbers pass the summer in flocks on the open water. These are not breeding birds, however. Easily decoyed, consequently great numbers are annually killed, but the species seem to hold its own as to numbers better than most ducks. The true scaup ducks are more largely animal feeders (especially on *mollusca*) than the next.

Aythya collaris *(Donov.).* **RING-NECKED DUCK.**

Very common during spring and fall, and to some extent a summer resident. Thirty to forty years ago the ring-neck nested in numbers anywhere in the state, and even at the present day some few nest regularly as far south as Rock County, and more in the less settled sections. We think this species is still as abundant during the migrations as thirty years ago. A most excellent table bird; feeds largely in fall on the same food as does the canvas-back. Usually known to Wisconsin gunners as "black-head" or "ring-bill."

Clangula clangula americana *(Bonap.)*. **AMERICAN GOLDEN-EYE.**

Common migrant and abundant winter resident wherever there is open water. Has apparently become a more common winter resident during the past fifty years. There are several breeding records for northern Wisconsin, and we have ourselves seen adult males at various northern points during the summer, but found no actual evidence of nesting. Fifty years ago this species was not considered as abundant as the next by Thure Kumlien in southern Wisconsin in winter. Three partial albinos have come under our notice, and one supposed hybid—*Clangula* x *Aythya*.

Clangula islandica *(Gmel.)*. **BARROW'S GOLDEN-EYE.**

Actual records for the state are not many. Reported from Racine in 1860 by Dr. Hoy. One specimen was sent to Thure Kumlien from Edgerton in 1877, and one was shot by L. Kumlien November 14, 1896, on Lake Koshkonong. Large numbers of golden-eyes remain on Lake Michigan during winter, and no doubt this species is of regular occurrence with them. Many remain all winter also in open water at Neenah and Menasha, and at different places on Fox River, but as these birds have not, to our knowledge, been studied with any care, we do not know how often *islandica* may occur. No distinction is generally made by gunners, so ornithologists get but few records from this source, and furthermore the females and immature birds are very difficult to distinguish from *americana* by anyone. In a copy of Rev. Mr. Barry's list of 1854, although he does not include this form, we find pencil notes by Thure Kumlien as follows: "*Clangula vulgaris* (= *C. c. americana*) only one specimen taken; is here not as common as *C. barrowii* (= *islandica*) in winter, 1854."

Charitonetta albeola *(Linn.)*. **BUFFLE-HEAD.**

Very common migrant in spring and fall, but greatly diminished in numbers of late years. Young still unable to fly have been shot on Pewaukee Lake by B. F. Goss, which is the only authentic breeding record for Wisconsin. Even this should be considered as exceptional. Immature birds are frequently taken in the larger inland lakes in summer, but are evidently not breeding. Universally known among Wisconsin hunters as "butterball."

Harelda hyemalis *(Linn.)*. **OLD-SQUAW.**

Very abundant on Lake Michigan in winter. During the unusually severe winter of 1880-81 hundreds froze to death in the ice off Milwaukee, and boys peddled them, principally bones and feathers, about the streets at ten cents a dozen. Of late years becoming more and more common on the inland waters. Twenty-five years ago it was considered "quite a take" in the interior, and those found were usually young birds in October and November. Now they are anything but rare on most of the larger lakes, and are sometimes taken in numbers, even in spring, but we have never seen them in Wisconsin in breeding plumage. On the lake a few arrive early in October, and their numbers increase until well along in the winter. By March they become restless, soon begin to gather in immense flocks, are then very noisy, and are all gone by early in April, except possibly a few in immature plumage which remain until well along in the month. When one has seen and heard these ducks as they arrive at their northern breeding grounds in immense flocks, and congregate on the ice about the open water in May, he does not wonder that Sundevall should speak of them as "*Anas canora, ob cantum vernalem suavem et sonorum*," for heard at some little distance, with several hundred voices in concert, it ceases to be a jabber, and is really melodious.

Histrionicus histrionicus *(Linn.)*. **HARLEQUIN DUCK.**

Rare winter straggler to Lake Michigan. Dr. Hoy obtained at least four specimens at Racine, and there is an old record, specimen not extant, however, for Milwaukee. Also reported from Lake Koshkonong, but on insufficient evidence, as is also the case with one other record for the state.

Somateria dresseri *Sharpe*. **AMERICAN EIDER.**

Lake Michigan in winter, rare. Recorded at Racine in winter of 1875, by Hoy. Two specimens were also taken at Milwaukee and were preserved in the Public Museum. The only positive record for the interior that we are aware of, is one specimen, a female, shot on Lake Koshkonong, in November, 1891.

Somateria spectabilis *(Linn.).* **KING EIDER.**

Although this species occurs only as a rare winter resident on Lake Michigan, there are more authentic records than of the preceding. Has been taken at Racine and there is now a specimen in the Milwaukee Public Museum, taken at Milwaukee many years ago. In the collection of Dr. E. Copeland and H. Russel, of Milwaukee, are two specimens taken at that point, a male, January 7, 1900, and a female, December 25, 1899. There was, about 1874, at Madison, a mounted immature plumaged male, said to have been shot on Lake Mendota; and in 1880 we saw in a fisherman's house near Sheboygan, a mounted male of this species in nearly full plumage. This specimen was caught during the winter in a gill net. During our sojourn on the Great Lakes we are positive of having seen king eiders in small flocks several times in late fall. Being very familiar with the bird in the Arctic regions, we think there was no mistake.

Oidemia americana *Swains.* **AMERICAN SCOTER.**

Rather common winter resident on Lake Michigan. Less common in the interior, occurring principally as a migrant in late fall. Rarely met in full plumage. The three species of "surf ducks" are apparently becoming more common, especially the next two, in autumn.

Oidemia deglandi *Bonap.* **WHITE-WINGED SCOTER.**

Much more common in the interior than the preceding. Found on all the larger inland waters from October until the ice makes. At times exceedingly abundant on Lake Michigan, vast flocks being met, at long distances from land. It is often taken in the fishermen's nets in deep water far from shore. Like the other scoters seldom met in full plumage. Called "coot" and "velvet duck" by the gunners, few distinguishing this from the other species.

Oidemia perspicillata *(Linn.).* **SURF SCOTER.**

Not rare on Lake Michigan in winter, and usually found on all the larger inland lakes in late fall. Seldom taken in the spring, most of the specimens being young or immature birds. For some unexplainable reason King's list of Wisconsin birds (1) does not even mention one of these three species of scoters as found in the state.

Erismatura jamaicensis *(Gmel.)*. **RUDDY DUCK.**

Common migrant, but not nearly as abundant as formerly. Until within a few years this duck was considered almost worthless for food by most people, and, as a consequence, escaped systematic hunting, especially as it seldom decoys or flies past a blind. It has, however, suddenly sprung into favor among sportsmen and will soon be rare. A duck of peculiar habits, it is not well adapted to "hold its own" against the warfare now waged upon it. A rather late arrival in southern Wisconsin, it moves southward again as soon as the ice forms. A few breed in the state, as about Lake Koshkonong, Pewaukee Lake, Lake Horicon (Goss), etc., but sparingly of late.

Nomonyx dominicus *(Linn.)*. **MASKED DUCK.**

Accidental. A single female was procured by Thure Kumlien on Rock River, near Newville, November, 1870, "and is now preserved in the collection of the Boston Society of Natural History" (2).

Chen hyperborea *(Pall.)*. **LESSER SNOW GOOSE.**

Migrant. Snow geese were formerly very abundant during the spring and fall migrations in Wisconsin, but of late years have so diminished in numbers that at the present time they are almost rare. Both species occur, in about equal numbers, so that what is said of one, applies equally to the other. More often met along the Mississippi River than in the interior or on Lake Michigan, especially in the fall, of late years. A few flocks still regularly pass up the eastern half of the state in spring, but it is a mere fraction of the former numbers. Nearly always associated with *C. cœrulescens* and *A. a. gambeli*.

Chen hyperborea nivalis *(Forst.)*. **GREATER SNOW GOOSE.**

Migrant, formerly abundant, now rather rare. We should say that possibly fifty per cent. of the snow geese taken in Wisconsin are intermediate between this variety and the last. Occasional flocks are seen passing high overhead, but of which form it is of course impossible to determine. Of the specimens examined, taken during the past sixty years and mostly when

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1. "Geology of Wis.," 1873-1879, Vol. I, p. 441-610.
2. North. Am. Birds, B., B. and R.

the birds were abundant, about one-half are typical of either *hyperborea* or *nivalis*, and in about equal numbers, and the balance intermediate. They feed sparingly now about the larger corn fields in southern Wisconsin, especially in spring, where they formerly resorted in large numbers.

Chen cærulescens *(Linn.)*. **BLUE GOOSE.**

Although by no means rare along the Mississippi, and in spring anywhere on the larger lakes and prairies, this species, as elsewhere, is none too well known in our state. It is of irregular and erratic occurrence in Wisconsin anywhere except along the Mississippi, and is usually found in the eastern counties associated with the snow or white-fronted goose, more often the latter. It is easily decoyed, and does not seem to have the ordinary "goose sense" of other species. We have it, in every stage of plumage, from Koshkonong and Delavan Lakes and the surrounding prairies. The "bald brant," as many sportsmen call the adult of this species, is usually an early spring migrant, sometimes arriving the latter part of February, but commonly in March. One specimen taken on Delavan Lake as late as April 18.

Anser albifrons gambeli *(Hartl.)*. **AMERICAN WHITE-FRONTED GOOSE.**

Formerly an exceedingly abundant spring and fall migrant, but of late years not at all plenty. Frequents the large prairie corn fields. This species has been credited by some as a summer resident, but it is extremely unlikely that it ever breeds in the state. Specimens have sometimes been taken as late as the middle of May, but there is no evidence that they were breeding, and individuals have been known to remain all summer in the flocks of tame geese on Lake Koshkonong. Commonly known as "brant," or "speckle-belly" among the Wisconsin gunners.

Branta canadensis *(Linn.)*. **CANADA GOOSE.**

Abundant, increasing rather than diminishing in numbers, during the fall, winter and spring. To such an extent has this species changed its habits that it is no longer looked upon as a sure harbinger of spring, as in most sections of southern and even south-central Wisconsin it remains all winter, flying back and forth from its favorite corn fields to some lake or large marsh for the night. When snow is plenty it even remains in the fields for days at a time. Twenty-five to fifty years ago the flocks which first made their appearance were noted by every one, and spring was not far distant. Now the flocks which return from the north in October are continually added to until they are often several hundred strong, and remain thus until the beginning of spring. Of late years the standing corn is cut with a machine, which not only cuts the corn but the weeds also, and this gives the geese a clear view of the surrounding country, which is one thing they must have in order to feed contented. Fifty years ago a common breeder in almost any swamp or large marsh, or on the "prairie sloughs" (now a feature of the past). At the present time only scattered pairs nest as far south as the southern third of the state. The last nesting record we have for southern Wisconsin was in Jefferson County—from the years 1891-99, inclusive, when a goose deposited her eggs on the edge of a tamarack swamp, on the same mound of rubbish each year. The first set was taken several times, when she moved to another mound farther into the swamp and here hatched her eggs. No mate was ever noticed to have visited her.

Branta canadensis hutchinsii *(Rich.)*. **HUTCHINS'S GOOSE.**

Typical ***hutchinsii*** is by no means rare in Wisconsin, especially in late fall and winter. A serious problem, however, confronts us when we attempt to draw the line between this and the foregoing variety, as every stage of difference between the two is represented by the hundreds of intermediates.

Branta canadensis minima *(Ridgw.)*. **CACKLING GOOSE.**

Credited to the fauna of Wisconsin in Ridgway's "Manual of North American Birds," the "A. O. U. Check List," and other works, as a straggling migrant. A small goose with short neck, minimum amount of black, dark underparts and distinct white crescent at the forward lower part of black neck marking is of frequent occurrence in Wisconsin, sometimes in large flocks made up of this kind entirely, and again in company with geese of every varying degree of size and marking. Specimens of this character have been examined of barely six pounds weight, and in the collection of Mr. Skavlem is a specimen weighing five and one-half pounds, which we think could be called typical ***minima***. These birds are locally known as "bull-necks" by the sportsmen. As with the case of ***hutchinsii***, compared with ***canadensis***, there are also intermediates of every varying degree between this form and both the others. There are occasionally large geese with dark underparts, slender necks and a distinct collar of white on lower neck. The white cheek patches appear to be indifferently separated by black on throat, or unbroken, among geese of all sizes, shape and coloration. We have examined carefully many dozens of fresh specimens killed at all times from early fall until late spring, and frankly admit our inability to satisfactorily unravel the "goose question" in Wisconsin. It is very likely that we have in winter these three varieties, and possibly four, with, as stated, every varying degree among the many intermediates.

Branta bernicla glaucogastra *(Brehm.)*. **WHITE-BELLIED BRANT.**

The brant has been listed as a bird of Wisconsin for a great many years, but when all records are sifted, we have left as authentic only the one of Dr. Hoy — a single specimen taken at Racine many years ago. This was one of three from the shore of Lake Michigan. For the past thirty years we have run down "brant" records innumerable — to find that in every case it proved to be something else, varying from the common Canada goose to a female eider duck! So persistently have we followed this up that we have come to the reasonable conclusion that this sole authentic record is merely accidental. We shall have no faith in any Wisconsin brant record unless accompanied by the brant itself. All of the smaller geese are universally called "brant," which makes it impossible to even consider a record except with suspicion. In the "Report of Bird Migration in the Mississippi Valley, 1884 and '85," by W. W. Cooke, we find statements that would indicate that this species, at least in 1883-4, was noted in Illinois, and that in Minnesota it became almost common. Prof. Cooke himself seems to question these records; and if they were obtained from no more reliable sources than *some* of the Wisconsin records were, they are absolutely worthless as proving the occurrence of the brant in the Mississippi Valley. Barry's list of 1854 says, "abundant in all parts of the State, and large numbers breed here." This is, of course, utterly false. Unfortunately the Hoy collection, now in the possession of Mrs. Wm. Henry Miller, of Racine, is left entirely without labels, and the records, or catalogues, have been lost or destroyed. The single brant preserved there is, without question, the specimen taken at Racine and is a perfectly typical *glaucogastra*.

Olor columbianus *(Ord.).* **WHISTLING SWAN.**

Migrant. During late fall, just before the larger lakes freeze over, this species is not at all rare in suitable localities. In the spring it is less regular, being much more numerous some years than others. Large numbers yearly visit Lake Koshkonong, and they are of regular occurrence at Delavan Lake, sometimes in goodly flocks. On Koshkonong they sometimes remain as late as May 1. Not commonly found on Lake Michigan, often common along the Mississippi, but probably more abundant in the Rock River Valley than in other parts of the state. April 2, 1896, four specimens were procured from a large flock on Lake Koshkonong. Two of these were full plumaged birds, perfectly white with black feet and bills, the latter with the usual yellow spots. One younger (?) specimen had the bill clouded and blotched with pink, and the toes and *tarsi* somewhat mottled. The fourth had a plain pink bill, with no spots, and *tarsi* and toes milk white. Two of these are in the Hollister collection and two in the Kumlien collection. We are somewhat at a loss to account for the color of the bills and feet in two of the specimens, as, if characteristic of the young, all the young should show it; but we have procured a good many of the young (of the year?) in fall, and although many were in the dark plumage, *all* had black bills and feet. One other specimen in the Kumlien collection, killed in October, is of a uniform dingy ash color, with typical feet and bill, yellow spot included. Very variable in size also, some specimens fully as large as the next. The Kumlien collection contains a specimen which measured sixty-two inches in length.

Olor buccinator *(Rich.).* **TRUMPETER SWAN.**

At the present day the trumpeter swan is surely a very rare bird in Wisconsin, and it is not certain that it could, at any time during the past sixty years, have been called common. In the early forties "swan" were reported as nesting in southern Wisconsin (Dane and Jefferson Counties), and if this is true it was no doubt this species. Thure Kumlien had a juvenile specimen obtained somewhere between 1842-45 in Jefferson County, with down on the head and primaries still soft, color a dingy ash. This specimen was still in existence in 1900, and doubtless is yet. During the fall of 1857 a large flock alighted on the prairie east of Stoughton during a heavy snowstorm, was seen by some farmers, who reported the birds as unable to fly on account of the heavy snow and sleet, and over twenty were killed. Six of these were procured by Thure Kumlien and preserved. In the past fifteen years we have handled but two specimens. One was mounted for a hunter, who procured it from a flock of three on Lake Koshkonong May 6, 1893! This specimen contained *ova* the size of an ounce leaden bullet. A very large, fine male was also killed by L. K. on Rock River in March, 1892. Doubtless it occurs more frequently along the Mississippi River than in other parts of the state.

ORDER HERODIONES: HERONS, STORKS, IBISES, ETC.

FAMILY PLATALEIDÆ: SPOONBILLS.

Ajaia ajaja *(Linn).* **ROSEATE SPOONBILL.**

By reference to Rev. A. C. Barry's list of 1854 we find the following regarding this species: "Found along the Mississippi within the bounds of our state, and occasionally about our small lakes in the interior." The sole actual and positively authentic record, however, entitling the spoonbill to a place in the present list, is from the fragments, head, wing and leg, of a specimen procured by Indians at Indian Ford, on Rock River near Janesville in August, 1845, and preserved by Thure Kumlien. These remains are still extant in the Kumlien collection. Several early references to the peculiar red birds taken or seen in southern Wisconsin no doubt refer to this species, but are not authentic. When the bird was common and ranged north to southern Illinois, it doubtless wandered at times, after the breeding season in late summer, to our southern limits, as is the case with other species of *Herodiones.*

FAMILY IBIDIDÆ: IBISES.

Plegadis autumnalis *(Hasselq.).* **GLOSSY IBIS.**

Rare straggler, usually in late summer. In August, 1862, a collector employed by Thure Kumlien shot one of these birds on a large mud flat on Lake Koshkonong. The bird fell in tall grass in miry soil and he did not succeed in finding it. His description of the bird aroused Mr. Kumlien's curiosity, and the next day a more extended search was made, which resulted in the specimen being found, in such a state, however, that only enough was preserved for identification. In September, 1872, T. and L. Kumlien saw seven on a large mud flat near Black Hawk Island, Lake Koshkonong, but did not succeed in getting within range. A specimen was shot on Lake Horicon (now Horicon Marsh) November 3, 1879, and is preserved in the Milwaukee Public Museum. We have positively seen this bird on the Mississippi near Prairie du Chien in August, some twenty years ago.

FAMILY CICONIIDÆ: STORKS AND WOOD IBISES.

Tantalus loculator *Linn.* **WOOD IBIS.**

There are recorded several captures of this southern species within the state. Can be classed only as a very rare midsummer straggler at the present day, however. It is, or was, supposed to ascend the Mississippi in July and August quite regularly, on hearsay evidence alone. Rev. A. C. Barry in 1854 refers to a specimen shot at Milwaukee "a year or two since," which may be the same specimen referred to by Dr. Hoy in 1852, as "in the Museum of the Wisconsin State Historical Society at Madison, which was shot near Milwaukee, September, 1852." We were informed, however, that the specimen in Madison was shot on the Mississippi at La Crosse in 1852, and the Milwaukee specimen was preserved in the Museum of the old Natural History Society there. Dr. Hoy also procured a specimen at Racine in September, 1868 (1). A specimen was mounted by S. Sercomb at an early date, killed on Rock River, between Janesville and Edgerton. This specimen was seen and examined by Thure Kumlien, but as it was the property of a private individual, we do not know if it is still in existence.

FAMILY ARDEIDÆ: HERONS, BITTERNS, ETC.

Botaurus lentiginosus *(Montag.).* **AMERICAN BITTERN.**

Common summer resident in all suitable localities from the southern tier of counties northward, but most numerous in the southern third of the state. A few remain in the fall until severe weather sets in, sometimes even into November. The idiotic practice of so-called "sportsmen" invariably to kill these

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1. Letter from Dr. Hoy to L. Kumlien. Nelson, Birds N. E. Ill., gives the date as 1869.

birds as they are flushed from the grass and along the shores of lakes has gradually reduced their numbers until they are not nearly as numerous as formerly. We have reared the young from the nest and kept them through the winter, and we only regret that Elliott Coues did not have our experience with them to add to his incomparable article on the life history of the species in his "Birds of the Northwest."

Ardetta exilis *(Gmel.)*. **LEAST BITTERN.**

Very abundant summer resident on all reedy swamps and lakes. This delicate little bittern, apparently so weak that it is a wonder it holds its own as it seems to do, does not remain after severe frosts in the autumn. A common breeding species, depositing its five to seven eggs (not three or four as often stated) on its frail nest among the tall rushes. A summer resident even to the shores of Lake Superior, but much more common in the southern counties.

Ardetta neoxena *Cory*. **CORY'S LEAST BITTERN.**

In June, 1845, Thure Kumlien found some Indian children playing with a small headless heron, using it as a target for bow and arrow practice. This was at an Indian encampment on Black Hawk Island, Lake Koshkonong. The bird was new to him and he secured it and later sent a color sketch to Dr. T. M. Brewer. Brewer pronounced it probably some southern species or a different plumage of the least bittern. A copy, or in fact the original sketch, is still in our possession, and it plainly shows the specimen to have been a typical *Ardetta neoxena*. No others were found and the matter was lost sight of by both Dr. Brewer and Kumlien. Neither was the bird ever found by L. Kumlien during many years of careful marsh collecting in the same locality. Its claim to a place in the present list, therefore, rests principally on the capture of a full plumaged male by Mr. C. E. Akeley on Lake Koshkonong, May 22, 1893, and preserved in the Field Columbian Museum, Chicago (1).

Ardea herodias *Linn*. **GREAT BLUE HERON.**

Rather common spring migrant. Nests in communities in different sections of the state, less frequently of late years than formerly, however. Breeding rookeries are found usually in large tamarack swamps, but at times in second-growth oak. Breeds from the southern tier of counties northward. The largest rookery we have ever visited was a short distance west

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1. Cherrie, Auk, XIII, p. 79.

of Two Rivers. Others are, or have been, at Fox Lake, Stevens Point, Waukesha, Barron County and other points; also, frequently, scattering pairs are found among the colonies of night herons or even singly. By the middle of August the young begin to spread over all sections of the state, and "blue cranes" are then abundant until fall.

Ardea egretta *Gmel.* **AMERICAN EGRET.**

Twenty-five to fifty years ago the egret was a common bird on the larger marshes and swamps bordering the inland lakes and rivers. Of late years, thanks to the barbarous plume hunters, rare, so rare at the present time that three or four individuals only visit Lake Koshkonong each year where hundreds were found thirty years ago during August and September. A few single birds or small flocks rarely visit Delavan Lake during the early fall. Fifty years ago specimens were occasionally taken on Koshkonong in June, but were neyer found nesting. Young, unable to fly, were taken from a colony in a tamarack swamp near Jefferson in July, 1863. It was found breeding with a large colony of great blue herons to the westward of Two Rivers in June, 1880. Also reported as nesting near Waukesha in 1866.

Ardea candidissima *Gmel.* **SNOWY HERON.**

A rare and irregular visitor from the south during August and September. Has been procured on Lake Koshkonong from time to time for the past sixty years, but usually only one or two at a time, from the large flights of *egretta* which formerly visited the lake. The only adult bird in early summer that we have ever known in the State was taken on Koshkonong in June, 1860, and is preserved in the Kumlien collection. In August, 1886, Mr. H. L. Skavlem shot six of these birds from a flock of egrets, also on Lake Koshkonong. This is the last authentic record of any numbers that we know of. Of late years very rare. We have never been able to trace a capture of the snowy heron north of Milwaukee, Madison and La Crosse. Dr. Hoy's note on this species as a common bird, "nesting in communities in tamarack swamps," refers to the preceding species, or possibly the night heron, and was a conclusion formed by finding the snowy herons in the swamps in August, and even July, not knowing of their habit of northward migration in late summer.

Ardea cærulea *Linn.* **LITTLE BLUE HERON.**

Rare accidental straggler. A single individual was shot on Root River, Racine County, August 28, 1848, by Dr. P. R.

Hoy. A single wing of a decomposed specimen was preserved by Thure Kumlien. This was found on the shores of Lake Koshkonong in the early fifties. Both of these were young birds in the white plumage, and no doubt straggled northward with other young herons. These, we believe, are the only authentic records for the species in Wisconsin, and can only be considered as purely accidental.

Ardea virescens *Linn.* **GREEN HERON.**

Common summer resident. Does not nest in colonies, but usually in scattered pairs, sometimes two or three together in a favorable place along some wooded stream or pond. Found as far north as the shores of Lake Superior at least. Somewhat diminished in numbers of late.

Nycticorax nycticorax nævius *(Bodd.).* **BLACK-CROWNED NIGHT HERON.**

Common summer resident. Always somewhat erratic in distribution, sometimes frequenting only the thickest and most retired woods and swamps, and to a considerable extent nocturnal, or rather crepuscular in habits, it is easy to get a wrong impression of its numbers, and many people never suspect its presence. There is also no doubt that the night heron is much more numerous in Wisconsin than formerly. Large colonies, or breeding rookeries, have been located to our knowledge at Lake Koshkonong, Albion, Stoughton, Fox Lake and Delavan, as well as in many other localities. Seems to nest indifferently in trees or on the ground in marshes. The marsh nests that we have examined have always been placed among the cane (*Phragmites phragmites*), and not the wild rice, as stated by Nelson and others.

ORDER PALUDICOLÆ: CRANES, RAILS, ETC.

FAMILY GRUIDÆ: CRANES.

Grus americana *(Linn.).* **WHOOPING CRANE.**

Formerly of regular occurrence in the southern and western part of the state during migrations, unquestionably breeding to some extent. Thirty or forty years ago it was not rare to see a few among the enormous flocks of sandhill cranes during the October migrations, and even flocks composed entirely of this species. Of late years adults are exceedingly rare, and the last record we have of a Wisconsin capture was in October, 1878, when a fine old bird was shot in Green County and sent to Thure Kumlien. Even as long ago as 1840 they were rare along Lake Michigan, while they occurred in numbers along the Mississippi River and the west central part of the state. Among the flights of the common crane that often remain upon the larger dry marshes for two weeks or more in October, there are noticed a few large "yellowish" specimens that are presumably the young of the year of the whooping crane, but they are so shy that approach is practically impossible. Newspaper and other reports of flocks of "white cranes" and of specimens shot in various parts of the state of late years, refer to the american egret, and not to this species.

Grus canadensis *(Linn.).* **LITTLE BROWN CRANE.**

Rare straggler during early spring and late fall. During the latter part of March and the first part of April, 1894, a lone crane kept with a flock of Canada geese on Rock Prairie, near Johnstown, Rock County, for some days, and appeared to act as chief sentinel while the geese fed in the fields, always flying away with the geese when alarmed. This bird was killed on April 4 (1894) by L. Kumlien, and proved to be a fine plumaged male of this species—and very small. It is now preserved in the Museum of the Whitewater Normal School. At least one other, that we are positive of, was shot in Dane County late in the fall of 1879, and came into the possession of Thure Kumlien frozen stiff. This specimen was formerly in the Museum of Albion Academy.

Grus mexicana *(Müll.).* **SANDHILL CRANE.**

In an early day a very abundant migrant and common summer resident, from the southern border of the state northward. Although at the present time entirely absent from most thickly settled portions of the State, there are still many localities, even in southern Wisconsin, where it occurs regularly in good numbers. On the "Big Marsh" near Delavan cranes occur every spring and fall in numbers from one hundred to two hundred and fifty, remaining for nearly three weeks at a time. A nest of two eggs was procured on this marsh May 30, 1883. One of the eggs is preserved in the Hollister collection, the other having been broken. They were reported as nesting on the immense marsh near Palmyra, in 1898, and a few certainly bred near Mauston in 1896. The last authentic record for nesting in southeastern Wisconsin was of two pair which bred near Jefferson in 1900. There are also nesting records for Marquette and Plover during the past ten years, and unquestionably in many other places unknown to us. We have seen numbers of nests, but never noted one built up like a flamingo's nest as described by Dr. Hoy in 1852, although this might have been necessary in a very wet locality. So wary are these birds that of all that occur on the Delavan Marsh yearly we have known of but two being killed at this place in many years.

FAMILY RALLIDÆ: RAILS, GALLINULES, AND COOTS.

Rallus elegans *Aud.* **KING RAIL.**

Summer resident, much commoner than twenty-five years ago. A regular breeder in suitable localities throughout the state, but far less plenty west of the Rock River Valley than east of it. The value of this bird for table purposes has come to be recognized in many sections, and it is regularly hunted with a dog. Occurs in much higher and drier situations than any of the other rails, and often frequents stubble fields when not too far away from the marsh. We have found the œsophagus literally crammed with oats, and in the latter part of the summer and early fall the birds subsist largely on grasshoppers.

Rallus virginianus *Linn.* **VIRGINIA RAIL.**

Rather common summer resident, but in no such numbers as the next. To be found almost anywhere in low swampy land and, except when it first arrives, in late April, keeps well under cover unless flushed. There is no question that this species has become more abundant than formerly in southern Wisconsin. The Virginia rail possesses the power of ventriloquism to an extraordinary degree, and its note is also exceedingly variable. A specimen kept alive in a wire netting enclosure in a large spring one summer taught us that there was hardly any note or noise commonly heard in the marshes that he could not imitate, so wonderful were his powers of mimicry. Nests in rather higher situations than the sora.

Porzana carolina *(Linn.).* **SORA.**

A very abundant summer resident. Breeds in suitable localities over the entire state. Arrives in spring from May 1 to 10, and moves southward after the first sharp frost, although belated individuals are sometimes found well into November. Formerly not molested by gunners, but has gradually come to be considered a game bird and large numbers are shot in the wild rice marshes from the first to the middle of September. Large numbers of their nests are destroyed by the rising of the water on their breeding grounds, and many of the migrating birds are killed by flying into buildings and wires; but with all this destruction the little sora seems to hold its own in numbers in a wonderful way.

Porzana noveboracensis *(Gmel.).* **YELLOW RAIL.**

Summer resident. This little rail is not nearly so rare as generally supposed, though by no means common. We have authentic records from Racine, Milwaukee, Elm Grove, Delavan, Janesville, Milton, etc., and even breeding records as far north as Brown County. There appears to be no record for the western part of the state, but this does not necessarily imply that the bird does not occur there. The note of this rail is not generally recognized by observers and owing to its retiring habits and the difficulty usually experienced in flushing it from the grass it is very seldom seen.

Porzana jamaicensis *(Gmel.).* **BLACK RAIL.**

Although Mr. Nelson (1) found this species breeding in northeastern Illinois and considered it of not very rare occurrence, it seems to have almost entirely escaped the Wisconsin ornithologists as yet. In fact, the only record we are aware of is the following: August 20, 1877 (2), a marsh hawk was killed by Frithiof Kumlien from a muskrat house on the border of Lake Koshkonong. When noted first it was eating something, and this proved to be a little black rail. We are quite sure of having seen it on one occasion, but the above is probably the only authentic record for the state as yet.

Ionornis martinica *(Linn.).* **PURPLE GALLINULE.**

Exceedingly rare straggler from the south. Most of the records obtainable are far from satisfactory, but the bird is without question entitled to a place in the Wisconsin list. Barry's list of 1854 says "a few breed here every season" (Racine); but inasmuch as the same list does not mention the following species we are inclined to think a mistake has

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1. Birds of N. E. Ill., p. 134, 1877.
2. Possibly 1879, the last figure is badly blurred.

been made, especially as Dr. Hoy's list of 1852, from the same locality, does not include it. Dr. Hoy procured it later, however, at Racine, and we once handled a specimen said to have been shot north of Milwaukee, about 1860. One other specimen was also sent to Thure Kumlien in a decomposed condition at an early day, some time in the fifties. This specimen was killed near Janesville, and there can be no doubt as to its authenticity. There are also two or more other records about which there is suspicion. We once purchased a specimen labeled "Wis.," but could trace it no farther, and believe the locality may possibly have been substituted to suit the occasion.

Gallinula galeata *(Licht.).* **FLORIDA GALLINULE.**

A common summer resident as far as the north central portion of the state, and in less numbers to the shore of Lake Superior. Has apparently increased in numbers during the past thirty years, at least locally. We have reared the young of this species and the next a number of times, setting the eggs under a hen and feeding the chicks on baked cake, composed of cornmeal, oatmeal, bran and beef. An excellent table bird, and a very interesting species whose life history we think is but imperfectly known, and worthy of the closest investigation. We have found as high as seventeen eggs in one nest, although ten to fourteen is the common number. As soon as the first eggs are deposited incubation begins, the sun doing the work by day and the female parent by night. The first hatched young are thus two weeks old ofttimes before the last egg is hatched. The young as fast as hatched are cared for by the male, but are to a certain extent competent to care for themselves very soon. A ventriloquist of extraordinary powers.

Fulica americana *Gmel.* **AMERICAN COOT.**

Very abundant spring and fall migrant on all the lakes and larger rivers. A breeding species in considerable numbers anywhere in the state, but by far the greater number pass beyond our borders to nest. Nests in similar localities to the preceding, but is otherwise very different in its habits, the coot frequenting open water like a duck, while the gallinule, rail-like, seeks the cover of grass or rushes. Arrives early and remains until the lakes freeze over. Apparently has not decreased in numbers during the past thirty years. This bird is very liable to become bewildered during its nocturnal migrations and is often found in cities and about the outbuildings of farms a long distance from water. Known to most of our gunners as the "mud-hen" or "pull-do" (1).

ORDER LIMICOLÆ: SHORE BIRDS.

FAMILY PHALAROPODIDÆ: PHALAROPES.

Crymophilus fulicarius *(Linn.)* **RED PHALAROPE.**

Small flocks may be met on Lake Michigan and Lake Superior in autumn, and occasionally straggling individuals wander to the larger inland lakes. Four specimens, one adult female and three young of the year were taken on Lake Koshkonong September 3, 1891. We have but a single state record for the early part of the season, a solitary female killed by Thure Kumlien on Lake Koshkonong June 4, 1877. This bird was only just beginning to show the red summer plumage and there was nothing to indicate that it would have bred that season. We have seen flocks of waders on Lake Superior in October that were no doubt this species, but stormy weather and distance prevented positive identification. We know of no other wader, however, except the next, that would light on the icy waters of Lake Superior many miles from land in late autumn. Our acquaintance with this species in the arctic regions makes us feel sure of the identification; and Dr. Hoy notes it from off Racine in November, 1847.

Phalaropus lobatus *(Linn.).* **NORTHERN PHALAROPE.**

Much more common than the red phalarope. Noted on Lake Michigan and Lake Superior in September and October, and a regular spring and fall migrant on Lake Koshkonong, though more often taken in fall than spring. Frequently taken on Lake Koshkonong in August, and once as early as August 3 (1873). Often found in the open water of the larger lakes swimming with the coots far from shore. Birds in breeding plumage are rare in Wisconsin; even such as are procured in May and June are still principally in the winter dress. Twenty-five years ago it was no uncommon occurrence to have a flock of half a dozen or more light among the duck hunters' decoys

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1. A corruption of the French *poule d'eau* (water hen), as the bird is called in Louisiana. Trumbull, Names and Portraits of Birds," New York, 1888, p. 117.

on Koshkonong. Even when feeding with other waders along the shore it will be most often found outside the shore line, where it must swim instead of wade in order to feed.

Steganopus tricolor *(Vieill.).* **WILSON'S PHALAROPE.**

This, the most beautiful of all our waders, is a common summer resident in Wisconsin, breeding in larger or smaller colonies in many different parts of the state. Such breeding colonies are found near Pewaukee, at three different places near Lake Koshkonong, at Albion, Whitewater, Packwaukee and Green Bay, and, in fact, at any suitable place. One colony at Lake Koshkonong has been known to have more than two hundred pairs on the marsh at one time. Arrives in southern Wisconsin in full breeding plumage. At some localities in the state the bird appears to be a rather rare migrant only.

FAMILY RECURVIROSTRIDÆ: AVOCETS AND STILTS.

Recurvirostra americana *Gmel.* **AMERICAN AVOCET.**

Specimens of this peculiar wader were taken by Thure Kumlien at different times from 1844 to 1875. Three were shot on Lake Koshkonong September, 1873. Bred in Green Bay in 1879, where downy young were seen in the possession of a taxidermist by L. Kumlien. Those taken by Thure Kumlien were more often taken in September and October, and were principally young birds. A specimen in the Milwaukee Public Museum is labeled "Wis." At the present time it must be considered as exceptionally rare.

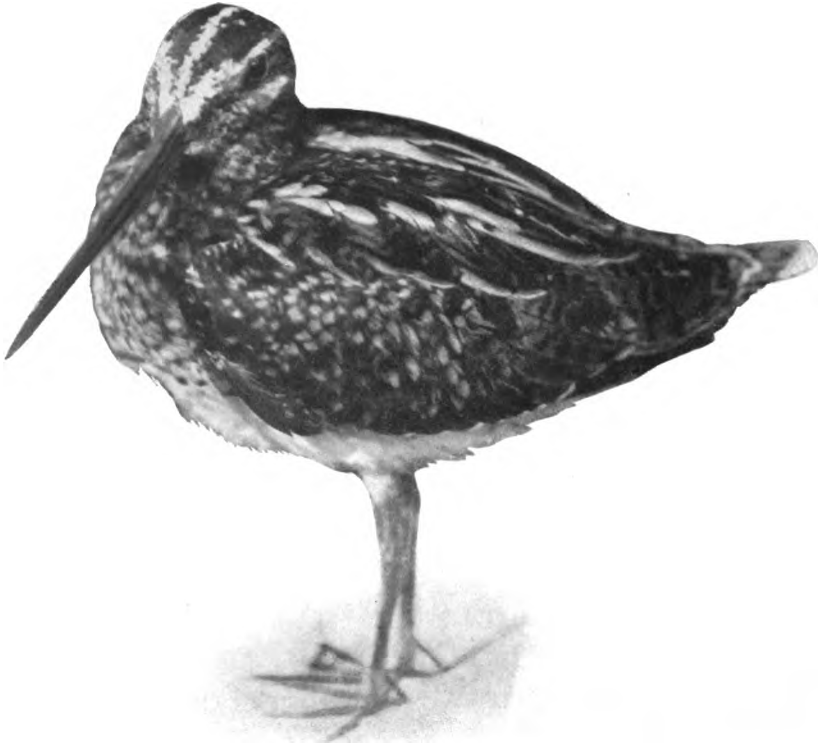
Himantopus mexicanus *Müll.* **BLACK-NECKED STILT.**

Very rare straggler. As far as we are aware the only record of this species for the state is that of Dr. Hoy, who states that "he met a small flock of these singular birds near Racine, April, 1847." The single specimen preserved in his collection was probably taken at this time.

FAMILY SCOLOPACIDÆ: SNIPES, SANDPIPERS, ETC.

Philohela minor *(Gmel.).* **AMERICAN WOODCOCK.**

Summer resident. Rapidly diminishing in numbers, though not an uncommon bird in suitable localities throughout the state. On the evidence of Thure Kumlien, Dr. Hoy, and others this species increased from the early forties up to



WILSON'S SNIPE.

Photo. from Life by F. E BURROWS.

say about 1870. From that time on to the present its numbers have decreased, from too close shooting, settlement of the country, and the draining and drying up of its natural resorts. An early breeder in bottom lands along streams, the eggs sometimes found in April. In fall remains until we have had very sharp frosts.

Gallinago delicata *(Ord.).* **WILSON'S SNIPE.**

Still a common species in most parts of the state—we might say abundant if it were not that we should be at a loss to express its numbers in former years. Arrives in southern Wisconsin early in April, and a large portion have passed north before May 1. A goodly number nest within the state as yet, even in the southern part. We procured two sets of eggs at Lake Koshkonong in May, 1891, and one set May 20, 1893, and were it not for the fact that the nest ***can not*** be discovered unless one flushes the bird, a good many might still be found. Mr. S. R. Hartwell, of Milwaukee, writes that it is still found to some extent in Waukesha County in summer, but that the nest is rarely found. He obtained a set of four eggs May 30, 1890, near Waukesha. Thirty-five years ago a nest was no rarity at all. By September 1 it begins to return from the north, yet unless there have been sharp frosts it is not very plenty until October, and it remains until well into November. A few are always found about open spring holes all winter. Of late so persistently hunted that it has materially decreased in numbers, even during the past ten years or less.

Macrorhamphus griseus *(Gmel.).* **DOWITCHER.**

Formerly a common migrant, now exceedingly rare. We have but one specimen of this form of the dowitcher in our collections, from Lake Koshkonong, although hundreds were formerly killed. There are, in the Milwaukee Public Museum, two specimens, these also from Koshkonong, taken in August, 1886. See remarks under next species.

Macrorhamphus scolopaceus *(Say).* **LONG-BILLED DOWITCHER.**

In order to rightly understand the following it is necessary to have some knowledge of the conditions as they existed in southern Wisconsin, and especially about Lake Koshkonong, from about 1865 to 1875. In the first place the shore birds, with the exception of the woodcock, and to a limited extent the jack snipe, were undisturbed by the gunners. No one thought of shooting them in the spring, and the consequence was that thousands upon thousands gathered upon the mud flats and remained for much longer periods than now. At this time also we recognized no specific difference between *scolopaceus* and *griseus*, for although we were well aware of a difference, especially in the length of the bill, there was every intermediate degree in measurements between the larger and smaller in this respect, and we had not classed them as distinct species. Consequently, these remarks must unfortunately apply to both species, as at this day we are utterly at a loss to say which species predominated, though we think *scolopaceus* did. Our collection to-day contains but one of each species, so that this is no guide whatever. As to the numbers of dowitchers that frequented Lake Koshkonong thirty to thirty-five years ago, during May, June, July, August and September, we forbear to attempt an estimate, as the younger generation would set it down as fabulous. Common as they were, often through July, but always less in this month than any other from May to October, but *very* few bred. Young still unable or barely able to fly were taken on several occasions. There is positively no question that considerable numbers bred in Wisconsin from 1865 to 1875 and in 1872 and 1873 as far south as Lake Koshkonong. In August the fully fledged young returned from the north in great flocks. The dowitchers were probably never as plenty on Lake Michigan as along the Rock River Valley. We incline to this opinion because Dr. Hoy did not find them in any numbers along the lake, and when he saw the flocks during a visit to Lake Koshkonong in June, his exclamations and gesticulations can only be imagined by those who were favored with his acquaintance. Nelson speaks of them only as a "rather common migrant" in northeastern Illinois in 1876. In Wisconsin at the present time they are known only during migrations and then sparingly. A few appear in May and June, and a very few at that, and again in August and September, but so irregularly that they may pass as rare. We have here a good illustration of what continual spring shooting can accomplish. For years the dowitchers were shot over decoys on Lake Koshkonong for the Chicago market, in May and the first half of June, until they have been practically exterminated. We are informed that from 1877 to 1880 two men averaged ten dozen a day during May and June!

Micropalama himantopus *(Bonap.).* **STILT SANDPIPER.**

Migrant and doubtless a former summer breeder to a limited extent. Of rather irregular occurrence, sometimes rare and again in such numbers that a dozen might be killed at a single shot. We have never seen them along Lake Michigan and they were almost unknown to Hoy. No doubt the greater number pass up the Mississippi, a considerable number branching off and passing up the Rock River Valley, and finding a place like Lake Koshkonong, just suited to their tastes, remain there longer than elsewhere. During the seventies they were rather common about Koshkonong, especially during the latter part of July, August and well into September. We have taken young barely able to fly, readily running them down; these had the head and upper neck still in the natal down, and if they were not hatched at Lake Koshkonong, certainly they could have come but a short distance. But few are taken in full breeding plumage, and at the present day they are decidedly rare in spring. Mr. J. N. Clark has taken the stilt sandpiper in Dunn County, three or four specimens in August and September, 1896; and Mr. W. E. Snyder reports a single capture at Beaver Dam.

Tringa canutus *Linn.* **KNOT.**

Thirty years ago a rather common migrant in May and June, and more sparingly in autumn. Of late years decidedly rare at any season. When common it was often taken in full breeding plumage. We have several times, especially in 1872 and 1873, the famous snipe years at Lake Koshkonong, taken knots in June and July, but there was no evidence that they were nesting, and if we are not mistaken they have been taken in mid-summer in Louisiana. Rarer on Lake Michigan, where we have seen small flocks in May several times in 1881-83.

Tringa maritima *Brünn.* **PURPLE SANDPIPER.**

Rare migrant. Dr Hoy states in his list of 1852 that this species was "greatly abundant" at Racine, from April 15 to May 20. As far as our personal observation goes we are inclined to think that the bird occurs only as an exceedingly rare straggler, at least at the present day. We have never seen, much less procured, one in the state. In the collection of the Oshkosh Normal School is a specimen which was said to have been taken at Bay View (Door County) in May, 1881.

Tringa maculata *Vieill.* **PECTORAL SANDPIPER.**

Twenty-five years ago an exceedingly abundant migrant during May, September and October. Of late, thanks to spring snipe shooting, the bird has decreased in numbers until now it is hardly common. Nelson speaks of a few remaining through the summer in northeastern Illinois (1877), and a few formerly spent the entire summer about the Koshkonong marshes, but there was never any evidence of breeding. At an early day, probably some time in the fifties, Thure Kumlien sent June skins to John Cassin, of Philadelphia, and Cassin, supposing it sufficient evidence that the pectoral sandpiper bred in Wisconsin, published a statement to this effect, on no other evidence, however, than the date when the birds were shot. It has been stated by different authorities that the bird breeds in Wisconsin, but no doubt they can all be traced to Cassin's premature conclusions. More numerous in the interior than on Lake Michigan.

Tringa fuscicollis *Vieill.* **WHITE-RUMPED SANDPIPER.**

Of regular occurrence at about the same time as the next, but by no means an abundant species. The white-rumps are in fine breeding plumage by the first week in June, and the females then contain *ova* the size of large peas. Small flocks of a dozen or less are sometimes found about Lake Koshkonong until the middle of June, and they are back again with barely full fledged young by August 1. It thus stands to reason that some of them, at least, can not go far north to nest. We have no evidence, however, that they ever breed in Wisconsin.

Tringa bairdii *(Coues).* **BAIRD'S SANDPIPER.**

Regular migrant in small numbers. Most often found in May, but frequently in August and up to the middle of September. In 1872 and 1873, the years the waders remained in such numbers the entire summer at Lake Koshkonong, they were the most abundant ever known, before or since. With the exception of these two years we have no records of summer specimens, and even at that time had no suspicion that those remaining bred. Mr. Clark finds this sandpiper a regular migrant in Dunn County, and has sent us specimens. Contrary to our observation he finds *bairdii* more common than *fuscicollis.*

Tringa minutilla *Vieill.* **LEAST SANDPIPER.**

Common migrant, especially in May and August. Arrives about May 1 and a few remain until well into June. The greater part are back again by the middle of August, many having already returned by the first of the month. We have known of at least two instances of this bird's nesting within the state, and from specimens seen in various parts of the north and central portions of the state, suspect that, at least twenty years ago, it bred in some numbers. Dr. Hoy, in 1852, called it common, and stated that it nested in the reedy marshes. Nelson also found it nesting on the Calumet marshes in northeasern Illinois in June, 1875. A breeding female, shot June 10, 1876, on Lake Koshkonong, and now in the Kumlien collection, has the entire back black, with merely a slight edging of rusty color on the tips of the inner tertiaries. It can hardy be called as plentiful in Wisconsin as the semipalmated sandpiper, and, contrary to the case with that bird, is more abundant on the interior lakes than on the shores of Lake Michigan.

Tringa alpina pacifica *(Coues).* **RED-BACKED SANDPIPER.**

Very abundant migrant in May along the Rock River Valley, remaining some time in favorable localities. So plentiful are the red-backs at times that we saw, in May, 1899, fifty-three individuals killed by the discharge of a double-barreled shot gun, and the entire flock of several hundred birds immediately alighted among their slaughtered companions, so that the same performance could have been repeated. In the spring all are in full breeding plumage, but show an immense variation in the amount of black on the under parts. On its return in September and October it is much less common, except along Lake Michigan, and is then always in winter plumage. Such specimens as have been found in summer have always proved to be wounded birds.

Ereunetes pusillus *(Linn.).* **SEMIPALMATED SANDPIPER.**

This little sandpiper is quite abundant in southern Wisconsin during May and the first half of June, and so many are summer residents that one easily gets the impression that it nests. Evidence of breeding is, however, entirely lacking, although specimens shot on Lake Koshkonong June 16, 1897, contained *ova* the size of medium hazel nuts and were in full breeding plumage. The majority of the birds which remain all summer do not assume this dress, however. They begin to gather in considerable flocks, associated more or less with other species, by the middle of August, and remain until there has been a severe freeze. On Lake Michigan this species remains much later than in the interior. Mr. Clark finds it most abundant in Dunn County in August.

Ereunetes occidentalis *Lawr.* **WESTERN SANDPIPER.**

Migrant. Not nearly as common as the preceding, yet of regular occurrence in May and often up to the middle of June. We have no state records for the fall, and have never personally taken it anywhere except on Lake Koshkonong, but it doubtless occurs in all suitable localities, a few individuals with the large flights of *pusillus*. Much more readily distinguished from the semipalmated when both are in breeding plumage. The somewhat larger bill and the extended reddish-brown patch at the back of the head are distinguishing characters.

Calidris arenaria *(Linn.).* **SANDERLING.**

Common migrant along the shore of Lake Michigan in May, August, September and October. Less common in the interior, especially of late years. Formerly quite common about Lake Koshkonong, and, as with many of the waders, a few non-breeding birds remained all summer. Frequents the sandy shores exclusively, and not the mud flats like most of the shore birds. The winter plumaged adults and young are readily detected among the large flights of smaller sandpipers by their lighter colored feathering.

Limosa fedoa *(Linn.).* **MARBLED GODWIT.**

Formerly not very rare during migrations, but of late years, except along the Mississippi and in the northwestern part of the state, has almost entirely disappeared. Was not considered uncommon by Dr. Hoy in 1852, and a pair seen June 15, 1848, on the Wisconsin River, were supposed to be nesting. Thure Kumlien took his first pair at Lake Koshkonong, May 25, 1855. We have seen the bird in Green Bay and on Lake Winnebago, but our acquaintance with it in Wisconsin is principally from Lake Koshkonong, where it was not rare from 1870 to 1876, and in 1857-59 it was known to nest in two instances, once near Stoughton and once at the lake. There is, in the Kumlien collection a perfect egg taken from the oviduct of a female shot May 28, 1878, in the eastern part of Dane County. Mr. H. Nehrling gives it as breeding in the northern peninsula of Michigan, and it used to nest in Iron County, Wisconsin, and almost certainly along Green Bay. At the present time one of the rarest of the waders in Wisconsin.

Limosa hæmastica *(Linn.).* **HUDSONIAN GODWIT.**

Migrant only. We have never known this godwit to occur anywhere within the state in any numbers, and of late years it must be considered very rare. Dr. Hoy procured a single specimen at Racine, November 1, 1850. At Lake Koshkonong it was taken regularly in small numbers up to about 1885; since then very rarely. Appears to have been more common along the Mississippi River than elsewhere in the state. Three specimens were taken near Albion, June 3, 1870, which is the latest record for spring that we have. These birds were doubtless just about to leave for more northern breeding grounds.

Totanus melanoleucus *(Gmel.).* **GREATER YELLOW-LEGS.**

Common migrant, spring and fall, and also a summer resident in the less thickly settled portions of the state. Arrives from April 10 to April 28, and in autumn often remains until it freezes up. Dr. Hoy, in 1852, says of this species: "Abundant and nests in all large marshes." Mr. Nelson found it breeding in Northeastern Illinois in 1875, and Barry speaks of its nesting commonly in Wisconsin in 1854. Downy young were procured by L. Kumlien near Minnesota Junction in 1882. Noted only as a spring and fall migrant in Dunn County by Mr. J. N. Clark. The greater yellow-shanks is not as abundant as the next, yet occurs in considerable numbers in fall, and being readily called by imitating the note many are shot by gunners. It is in full breeding plumage by May 1 and nests in much the same situations as the next. At Lake Koshkonong it bred at considerable distances from the lake, far out in the miry marshes and did not often visit the lake shore until the young were nearly full grown.

Totanus flavipes *(Gmel.).* **YELLOW-LEGS.**

Formerly an exceedingly abundant migrant, and to a considerable extent a summer resident. Arrives in Wisconsin about the first of May, and rarely remains later than October. Formerly bred at Lake Koshkonong, Horicon Lake, about Lake Pacana, and presumably in other localities. Is shot in large numbers by the gunners at the present time, and is decreasing very fast in numbers. Young, still unable to fly, are yet obtainable about Lake Koshkonong in July, but of late years not commonly. Prefers to nest some distance from the lake shore in the large marshes. So closely does it keep in the marshes during the nesting season that a person might visit the lake shore daily and not see a specimen until the young are almost able to fly.

Helodromas solitarius *(Wils.)*. **SOLITARY SANDPIPER.**

A fairly common summer resident in suitable localities, breeding from the southern counties northward to Lake Superior and beyond. Arrives in southern Wisconsin about May 1, the larger number at once passing on. Returning, the northern birds, together with those which remained to breed, leave early for the south, few being seen after September 15. Not at all a "shore bird," its haunts are almost strictly along wooded streams and about closely timbered ponds. There is no Wisconsin bird of which we have so diligently and systematically sought the eggs, and without success, as this sandpiper. Numbers of times we have found the young just hatched, and judging from the actions of the parents have often been near the eggs.

Symphemia semipalmata *(Gmel.)*. **WILLET.**

None of the older Wisconsin ornithologists found the willet in any numbers. Dr. Hoy and Thure Kumlien spoke of it as a rare summer resident. The specimens secured during the past thirty years were usually taken in May and September, and although there are some records for June, we never found any evidence of nesting. Some numbers pass up the Mississippi and remain, or at least did, during June, in the marshy tracts in the western part of the state, possibly a few nesting. At the present time, however, it must be classed as a rare wader in Wisconsin. A good series taken at different seasons would doubtless prove the occurrence of the western form, *S. s. inornata* Brewst. within our borders at some time, if only as a straggler during migrations.

Bartramia longicauda *(Bechst.)*. **BARTRAMIAN SANDPIPER.**

This once abundant species is disappearing at such a rate that if the decrease in the next twenty years is as great as it has been since 1870 the bird will become extinct. Formerly every meadow, border of marsh, or grassy lake shore contained great numbers of this bird. Of late it is found in limited numbers only, but is a regular breeder, even in the southern counties, about prairie pastures and grain fields. Arrives about the first of April and but few remain after the first hard frost in September. The "prairie pigeon" was but little molested until it became generally known that it was one of our best table birds, and consequently brought a good price in the city markets. From that time on it has been slaughtered both spring and fall in great numbers, and this is still carried on wherever the birds exist in any numbers, and especially during the southern migrations. The abominable practice of hunting with dogs for market during the breeding season no longer pays in Wisconsin, and, thanks to our spring shooting laws, has been to a great extent stopped, but entirely too late to save more than a remnant of the flocks of "upland plover" which once nested within our borders.

Tryngites subruficollis *(Vieill.).* **BUFF-BREASTED SANDPIPER.**

Rare migrant. During a residence of fifty years in southern Wisconsin Thure Kumlien procured but a single specimen, killed on a prairie in Dane County late in September, 1845. On September 10, 1892, a single young male was killed by L. Kumlien on Rock Prairie, Rock County. Another young male was shot by Mr. Henry Skavlem at Lake Koshkonong, and is now preserved in the collection of the club house on the "Carcajou Farms" at that place. Dr. Hoy (1852) gives the species as "quite common from September 15 to October 10. Never met in spring." Willard (1) gives it as a regular migrant in Brown County. It is unfortunate that these writers have left only the bare statements as above. This species "should" pass through the prairie regions of Wisconsin during spring and fall migrations, but it certainly does *not*, except very rarely, in the central parts of the state. Possibly more frequent in the western counties. We consider it one of our rarest "shore birds." To be looked for in prairie regions only, in such localities as are frequented by the Bartramian sandpiper.

Actitis macularia *(Linn.).* **SPOTTED SANDPIPER.**

A very common summer resident, arriving late in April of an average year, and remaining until quite late in autumn. Nests from the southern part of the state to Lake Superior in all suitable localities, and almost any situation will suit if near water. Its nests are the most easily found of any of the waders, in fact it seems to display very little ingenuity in concealing the eggs. Does not appear to have diminished in numbers to any great extent during the past thirty years.

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1. List of Birds of Brown Co., Wis., Acad. Arts and Science, Vol. VI.

Numenius longirostris *Wils.* **LONG-BILLED CURLEW.**

This is one of the species of birds that have been almost entirely driven out of Wisconsin. Formerly not only common, but abundant, it is now so rare as to merit a special notice when found. During the forties, fifties and sixties it bred in suitable localities in different parts of the state. The last exact date of which we have any record for eggs is May, 1859, although it undoubtedly bred at a much later date in less thickly settled parts. From 1860 to 1890 it decreased rapidly, and when found at all it was as a migrant only. During the past ten years we have seen but two or three flocks on the prairie, in spring. As an illustration of the former numbers of the curlew Mr. Skavlem tells of his boyhood experiences, in the early fifties, when he was set to following the plows when breaking up the virgin prairie sod, and gathering up the eggs for the house. The curlew will not stay long on cultivated ground, but leaves with the disappearance of the original prairie sod.

Numenius hudsonicus *Lath.* **HUDSONIAN CURLEW.**

From 1845 to about 1865 this species was fairly common during migrations in the prairie regions. Dr. Hoy writes of finding a few nesting at Fox Lake, June 15, 1848, and Thure Kumlien found the birds in summer in Dane County, and from their actions supposed them to be nesting. We have no *positive* evidence, however, that the species ever bred in the state. It has certainly been decidedly rare during the past thirty years even in migrations, and we have not seen a single specimen for twelve years. "Curlews" are still reported from sections in the northwestern part of the state, but whether of this species or the foregoing is an unsettled question.

Numenius borealis *(Forst.).* **ESKIMO CURLEW.**

Exceedingly rare migrant. Thure Kumlien procured but two specimens during fifty years collecting in the State. Dr. Hoy took several in an early day, but considered them rare. A specimen, which we saw, was also shot in Green Bay in the fall of 1879.

FAMILY CHARADRIIDÆ: PLOVERS.

Sqatarola squatarola *(Linn.).* **BLACK-BELLIED PLOVER.**

Migrant, never very abundant, but occurring singly or in small flocks, both spring and fall. Generally visits southern Wisconsin about the middle of May, among the large flights of other shore birds, the great majority passing north about the first of June and returning late in August. If the weather is fine some remain until late into October. Numbers formerly remained, even in southern Wisconsin, the summer through, but we have no evidence of nesting; although Mr. Nelson seemed strongly to suspect that it did breed about Waukegan, Illinois, in 1876. That a few do nest not *very* far north of us is shown by the fact that young with the primaries still showing the remains of the "blood quills" used to be taken on Lake Koshkonong in August (Aug. 10, 2 specimens, Aug. 14 and 16, 1872, 1873). Older birds not in full breeding plumage also formerly occurred on Lake Koshkonong during June, July and August. During the past ten years the species has almost entirely disappeared. Mr. J. N. Clark considers it a very rare migrant in Dunn County, and has not seen a specimen since May 27, 1898.

Charadrius dominicus *Müll.* **AMERICAN GOLDEN PLOVER.**

Formerly very abundant, both in spring and fall, on the Wisconsin prairies, if there were heavy rains arriving about April 15 and remaining until the first week in May or even later (May 10, 12, 13, 1867, Rock County). Returns from the north from the first to the middle of September, but is much more common in October. Formerly an occasional specimen was taken in summer, but it is very rare at this time as compared with the last. There are several Koshkonong records for June and July, and a beautiful male in full breeding plumage was taken on Rock Prairie, Rock County, in June, 1892. Spring market shooting from Illinois southward and westward has so reduced its numbers that the golden plover is now almost rare in Wisconsin. A few are still found on the larger prairies in April and about the lakes in September and October. Late arrivals in spring are in almost perfect plumage. The numbers of these birds that frequented our prairies from 1840 to 1865 seem almost incredible to the younger generation. At that time the birds would scarcely get out of the way of the teams when the farmers were plowing, and followed, like chickens, in the furrow.

Ægialitis vocifera *(Linn.).* **KILLDEER.**

A common summer resident in suitable localities over the entire state. An early arrival in the spring often occurring as early as March 15, and there are even February records for the southern counties. Breeds early and departs for the south as soon as the ice forms.

Ægialitis semipalmata *Bonap.* **SEMIPALMATED PLOVER.**

Common migrant during May and first two weeks of June, and again during August and September. Numbers remain about the larger inland lakes and Lake Michigan during the summer. We procured the young, ***still unable to fly***, at Lake Koshkonong on one occasion. Specimens are often taken in August with the natal down still adhering to the feathers of the head and neck. Mr. Nelson believed that the species nested in northeastern Illinois in 1873, and near there at least in following years, and we are of the opinion that he was wholly correct in his surmises to that effect.

Ægialitis meloda *(Ord.).* **PIPING PLOVER.**

Not nearly as common in the interior of the state as the preceding species, but more frequent on Lake Michigan. Arrives earlier than the semipalmated. Formerly bred sparingly about Lake Koshkonong and near Sheboygan on the lake shore. At the present time the bird is too rare to get any definite information regarding its occurrence. From 1870 to 1900 this form did not frequent Lake Koshkonong and the surrounding lake country in such numbers as the next, or at any rate more specimens were procured with the complete "ring" than without. Dr. Hoy met with it only in fall and considered it uncommon, but at that date, 1852, did not of course recognize the two varieties. In June and July, 1873, the ring-necks were much more abundant at Lake Koshkonong than at any other time, before or since, of which we have record.

Ægialitis meloda circumcincta *Ridgw.* **BELTED PIPING PLOVER.**

What has been written in regard to the preceding variety applies equally to this form, except that *circumcincta* occurs in greater numbers. For some unexplainable reason this species, in common with all waders, and even those kinds which are never hunted, has greatly decreased in numbers of late years. This sub-species once bred about Lake Koshkonong and other favorable lakes, but is now almost entirely absent, except a limited number during migrations.

FAMILY APHRIZIDÆ: SURF BIRDS AND TURNSTONES.

Arenaria morinella *(Linn.).* **RUDDY TURNSTONE.**

Not an uncommon migrant, especially in spring. A few may be found in the large flocks of waders by May 20. These birds are in the full breeding plumage which they still retain when they return in August. Those procured in September begin to show the change to the winter dress. More common along the shore of Lake Michigan than in the interior. Small numbers remain about Lake Koshkonong until well into June, and a few in exceptional years remained all summer, but there was no evidence that they bred, as they very likely did not. We have seen these birds about Ontonagon, Michigan, in the latter part of July, and in Green Bay late in June; still they unquestionably breed only far north of us. Greatly reduced in numbers of late years.

ORDER GALLINÆ: GALLINACEOUS BIRDS.

FAMILY TETRAONIDÆ: GROUSE, PARTRIDGES, ETC.

Colinus virginianus *(Linn.).* **BOB-WHITE.**

Formerly a very abundant resident in southern and central parts of the state. In most sections the quail gradually decreased in numbers until about 1885 they were entirely absent from many localities where they were once common. The clearing away of underbrush and the introduction of wire fences in place of the old-fashioned rails, with their weed covered space on each side, probably had as much to do with their disappearance as too close or lawless shooting. For the past dozen years different shipments of birds, mostly from Kansas, have been turned loose in various localities. In some of these places the introduced birds seem to thrive wonderfully, and having been constantly protected by law for a term of years there seems good reason to think that the quail will in many sections become common again. A great deal has been said and written in regard to the introduction of these birds from a more southern latitude—that they could not withstand the winters of Wisconsin, etc. We have observed them very closely and doubt that there is any cause whatever for alarm. With the abundance of feed that is nowadays left out in every field, careful observance of the laws, and constant vigilance over that class of pot-hunters who, if they had their way, would destroy every game bird and animal in a year's time, there is no reason why the birds should not thrive and multiply.

Canachites canadensis canace *(Linn.).* **CANADIAN SPRUCE GROUSE.**

Fairly common resident in the pine regions of the state, but so far as we can learn has never been found south of the pine belt. Appears to be disappearing at rather a rapid rate, just why is not easily answered. We have personally met this species in different portions of northern Wisconsin for the past twenty-five years, but in constantly decreasing numbers. In some sections of our extreme northern counties many still remain.

Bonasa umbellus *(Linn.).* **RUFFED GROUSE.**

Common resident in favored sections of the south and central parts of the state, and almost abundant in some of the northern counties. The gradual clearing up of underbrush and tangled thickets, and the pasturing of woodland lots have driven the "partridge" from many of its old haunts. In the sections of northern Wisconsin where the grouse are still abundant, every subterfuge possible is practiced to evade the law in regard to shipments and the number each hunter is allowed to carry on the trains, and great quantities find their way into the city markets despite the strict and careful vigilance of the game wardens.

Bonasa umbellus togata *(Linn.).* **CANADIAN RUFFED GROUSE.**

Typical *togata* is rare in Wisconsin. A number of grouse supposed to be of this form appear to be only intermediates, and typical *umbellus* occurs in the most northern counties. In the Milwaukee Public Museum, however, are several examples of the true Canadian ruffed grouse, one especially typical example collected by L. Kumlien at Hudson, St. Croix County. A careful search will doubtless show this form, but only as a rarity, in the northwestern part of the state. Mr. Wm. Brewster writes us that although the Wisconsin and Michigan grouse that he has examined are darker and grayer than those from New England, they appear to be nearer *umbellus* than to true *togata*, which almost invariably has the entire throat barred transversely with dusky markings, a feature not found in our birds.

Lagopus lagopus *(Linn.).* **WILLOW PTARMIGAN.**

Exceedingly rare straggler from the north. Two specimens were captured in a trap at Racine in December, 1846, by Dr. P. R. Hoy. His additional note, in his list of 1852, that it "nests in the tangle of evergreen swamps in the northwestern parts of the state" rested on information furnished him by Indians, as he himself informed us years afterward. Many years ago a well known friend of ours, and a reliable naturalist, Prof. W. F. Bundy, furnished us with a note to the effect that he procured a ptarmigan in Sauk County in 1876. We are at present unable to learn Prof. Bundy's address and can give no details of this capture. Some time in the fifties a land hunter from the northern part of the state brought a mutilated, frozen ptarmigan to Thure Kumlien to show that his assertion that these birds, well known to him in his native Norway, *did* exist in Wisconsin, as Kumlien had probably intimated that they did not. During our sojourn on Lake Superior we made repeated inquiries in regard to this bird and received some interesting information — such as it is. It is certain, however, that the ptarmigan occurs as a rare winter visitor in the northern peninsula of Michigan, and formerly at least reached Wisconsin during the severest weather.

Tympanuchus americanus *(Reich.).* **PRAIRIE HEN.**

Common resident in many parts of the state. The prairie chicken seems to have moved westward with the settlement of the country. In the early forties it was rather rare in southern Wisconsin, and at the present time has almost entirely replaced the next. The species thrives well in cultivated sections if reasonably protected. Sensible legislation has resulted in a marked increase in its numbers during the past ten to fifteen years, and on the prairies and large tracts of wild dry marsh land, where it is allowed to nest unmolested, it is still quite plenty.

Pediœcetes phasianellus campestris *Ridgw.* **PRAIRIE SHARP-TAILED GROUSE.**

Resident. The sharp-tails seem to be rapidly giving way to the prairie hen, a species better adapted for life in a settled country. Referring back to 1840, we find that this species was the common prairie grouse of southern Wisconsin, and was at that time extremely abundant. Thure Kumlien had been a resident of Wisconsin several years before he saw a specimen of what is now our common prairie chicken. Dr. Hoy in 1852 says, "formerly quite common near Racine, now seldom met with." Mr. J. N. Clark writes us from Dunn County, "quite common up to about 1885, but now (1902) becoming very rare. Saw it last in 1900. Have never found it in company with the pinnated grouse, which is common here now." A few sharp-tails were found about Stevens Point in 1898, and scattered records have been received from Markesan and other points in the north central part of the state. The last record we have for southern Wisconsin is near Janesville, October, 1869 (specimen preserved). At the present time it is found in any numbers only in isolated sections of the central and northwestern part, and is probably doomed to speedy extinction in the state.

FAMILY PHASIANIDÆ: PHEASANTS, ETC.

Meleagris gallopavo fera *(Vieill.).* **WILD TURKEY.**

The wild turkey is to-day so rare in Wisconsin that it is safe to say that it is extinct. Authentic references are meagre and fragmentary. Dr. Hoy and others say it was abundant in southern Wisconsin prior to 1840. Several references, of which Hoy's is one of the most reliable, state that the winter of 1842 was practically fatal to them. The explanation as given is that "snow was yet two feet deep in March, with a stout crust, so that the turkeys could not get to the ground. They became so poor and weak that they could not fly, and thus became an easy prey to the wolves, foxes, wild cats, minks, etc., which exterminated almost the entire race" (1). Dr. Hoy speaks of turkeys last being seen at Racine in November, 1846. A fine specimen was shot at Waukesha in 1847. Mr. Skavlem, of Janesville, tells us that the last known record for Rock County was in the town of Newark, in 1854. Thure Kumlien had no records for Lake Koshkonong later than 1842. Said to have been killed in some numbers in the southwestern part of the state as late as 1856-58. Residents of the extreme southwestern counties claim that a few were found among the bluffs near the river as late as 1894, and it is highly probable that

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1. Hoy, Large animals,—time of their disappearance." History of Walworth Co., Wis., 1882. p. 138.

they were. Newspaper reports claim the capture of three at Boscobel in 1872. A few birds have been introduced and escaped from captivity of late years about Koshkonong, and it is not an impossibility that genuine "wild" turkeys may yet be taken in Wisconsin.

ORDER COLUMBÆ: PIGEONS.

FAMILY COLUMBIDÆ: PIGEONS.

Ectopistes migratorius *(Linn.).* **PASSENGER PIGEON.**

The wild pigeon was an abundant migrant and summer resident in many parts of the state until the years 1879-83. From that time to the present day the bird has been one of our rarest species. Mr. J. M. Blackford, now residing at Delavan, states that the last large catch of the netters was in 1882. The following spring but one hundred and thirty-eight dozen were taken in the best pigeon grounds in the state, and this was practically the end. Small flocks, pairs and solitary individuals have been reported from various parts of the state nearly every year since this time, however, and it is highly probable that a very few still nest in isolated pairs within its limits. Mr. J. N. Clark furnishes the following data for the past fifteen years in Dunn County: May 2, 1886, a nest containing one egg; June, 1890, nest containing one young; April 20, 1897, 3 seen, 1 taken; April 26, 1897, 3 seen; April 27, 1897, 2 seen; May 5, 1898, 1 pair seen, last record. Several have been taken and more seen about Milton during the same period of years. The last record of capture for Delavan was an immature male, single bird, taken at Delavan Lake, September 8, 1896. Mr. W. E. Snyder (1) reports but two records of the capture of pigeons at Beaver Dam in thirteen years.

Zenaidura macroura *(Linn.).* **MOURNING DOVE.**

Common summer resident. A few remain in southern Wisconsin through the winter, but the greater number arrive from the south about the first of April. In autumn the mourning dove is to some extent gregarious and the most of them move southward during October. One of the birds that is little affected by civilization and has so changed its habits that it is

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1. Bulletin of Wis. Nat. His. Soc. II, 2, p. 110.

now a regular and common breeder in thickly settled parts of every village, and even the large cities, and when unmolested becomes very tame.

ORDER RAPTORES: BIRDS OF PREY.

FAMILY CATHARTIDÆ: AMERICAN VULTURES.

Cathartes aura *(Linn.).* **TURKEY VULTURE.**

Of regular occurrence along the Mississippi at least as far north as Pierce County. We have records also for Racine, Milwaukee, Two Rivers, De Pere, Beaver Dam, Delavan, Stevens Point, Iron River (Bayfield County), etc., becides more than a dozen for Lake Koshkonong. These records are principally in July and August, although it has been taken at Koshkonong as early as April 28 and as late as November 2. The specimens are mostly young of the year. Grundtvig reports the vulture from Outagamie County in 1882 and 1883, and thinks it breeds near Shiocton, where he noted it during April, May, August and September (1). The species undoubtedly breeds sparingly in the southwestern part of the state. The principal food of the "buzzard" at Lake Koshkonong seems to be dead fish. There is a general impression among many people in the north that this bird, as well as all others of the *Raptores*, is in some manner "destructive" and should be killed at sight. This opinion prevails among many who should know better. The safe plan to follow is that *all* birds should be protected. We are not believers in the so-called "injurious" species and hope to see the day when no distinction will be made as to the birds which shall be protected.

FAMILY FALCONIDÆ: FALCONS, HAWKS, EAGLES, ETC.

Elanoides forficatus *(Linn.).* **SWALLOW-TAILED KITE.**

Thure Kumlien found this species breeding near Fort Atkinson in the summer of 1854. Prior to this date it was noted at different times in Jefferson, Rock and Dane Counties. According to Dr. Hoy it nested near Racine up to 1848, but

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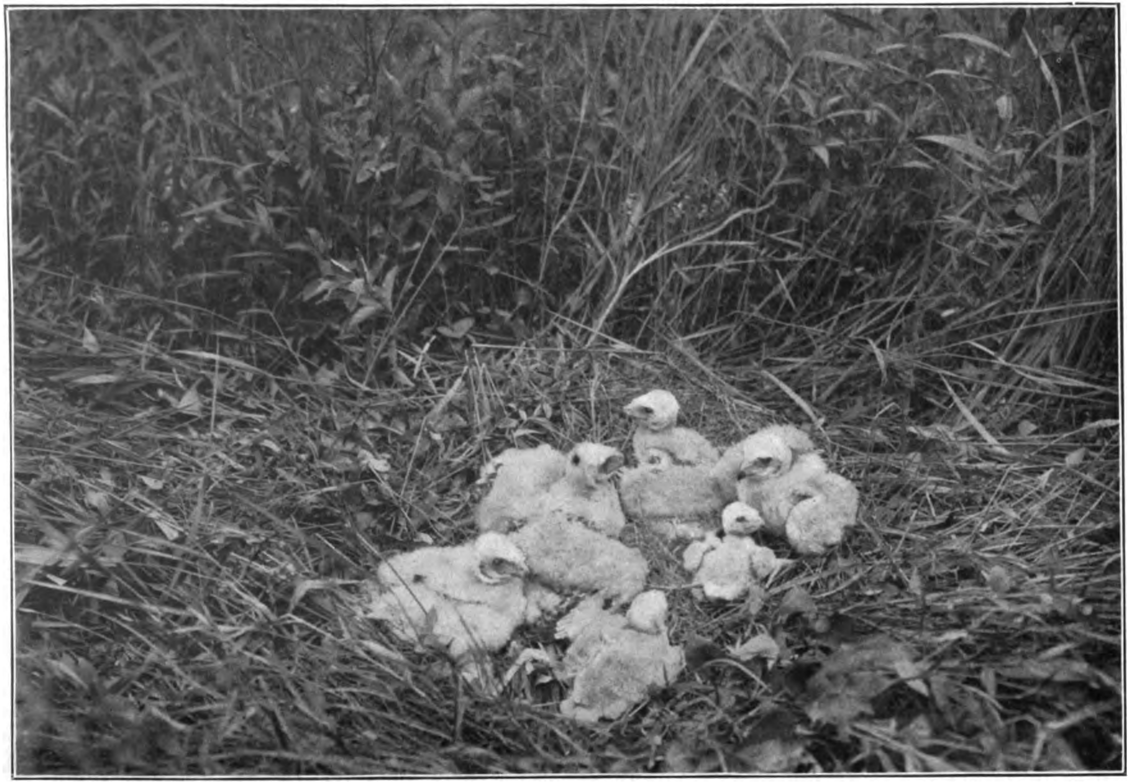
1. Trans. Wis. Acad. Sciences, Arts and Letters X. p. 107.



NEST OF YOUNG MARSH HAWKS.

Photo. by F. E. BURROWS.

abandoned the region about that time. He states that "they nested on tall elm trees about the 10th of June, and left us about the 1st of September" (1). Rev. Mr. Barry, also writing of the vicinity of Racine in 1854, says, "at one time quite numerous upon our prairies, and quite annoying to us in grouse shooting; now rarely met with in this vicinity." There is a specimen in the Milwaukee Public Museum, male, taken in Milwaukee County, May 15, 1888. Along the Mississippi River the swallow-tailed kite is more common and may still rarely breed. It is still a rare summer visitant in the east and central counties.

Circus hudsonius *(Linn.).* **MARSH HAWK.**

One of the commonest hawks of Wisconsin, in marshy or prairie sections. A summer resident, though specimens are frequently taken in southern Wisconsin as late as well into December. Nests in all suitable localities from the southern tier of counties northward. The marsh hawk subsists largely on frogs, etc., but does not hesitate to attack any smaller bird that it can overtake, even molesting the poultry about the farms bordering large marshes or low prairies. About reedy lakes where duck shooting is carried on it systematically hunts along the border of the lake for crippled ducks. We have even known it to carry off a dead duck but a short distance from the hunter who had just shot it. Appears to be more plentiful than thirty years ago.

Accipiter velox *(Wils.).* **SHARP-SHINNED HAWK.**

Very common as a migrant during the latter part of April and first three weeks of May, and again during September and October. A few remain during mild winters in the southern part of the state. We have found it nesting at Milton in two instances, but the majority go farther north. We have nesting records from Stevens Point, Iron County, Two Rivers, Madison, Racine, and, in fact, from so many widely separated localities that it can without doubt be considered as breeding at suitable points throughout the state, in greater numbers in the central and northern parts. During migration, both spring and fall, it follows the flights of smaller birds, feeding almost exclusively on them, and must destroy great numbers.

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1. Trans. Wis. State Agric. Society, 1852, p. 343.

Accipiter cooperii *(Bonap.).* **COOPER'S HAWK.**

Common summer resident, even in thickly settled parts of the state. Arrives in southern Wisconsin about the middle of April, and remains until the middle of October. Nests commonly in the black oak groves of "second growth" timber, but is in no wise restricted as to kind of tree. We have taken a set in a tamarack in a heavy swamp, and even in poplars. By far the most destructive hawk to poultry during the summer season. For daring, boldness and destructiveness it is only equalled by the goshawk in winter. Nests early in May, and frequently a second brood is reared. This hawk will at times nest in close proximity to a farm house, but with a great display of cunning will draw on some distant poultry yard for supplies until the young are ready to leave the nest. This hawk is much more common than thirty years ago, at any rate locally. In rare instances noted during mild winters in southern Wisconsin.

Accipiter atricapillus *(Wils.).* **AMERICAN GOSHAWK.**

A regular winter resident, formerly even well into Illinois. At the present time the goshawk is becoming rarer, even in the central and northern parts of the state. Dr. Hoy, in 1852, speaks of it as occurring at all seasons, the adults only in winter. Our personal recollection is that it was the young birds which were so destructive to poultry thirty years ago, in winter. Barry writes of its abundance in the early fifties, mentioning that a friend shot twenty in one season. Thure Kumlien considered it a rare summer resident at an early day, but personally or from other observers we have no positive nesting records, although the species perhaps bred in the northern portions of the state. Mr. J. N. Clark finds it a regular winter visitant in Dunn County, some winters abundant, but growing less common. We have taken three adults at Milton during the past ten years. Lives almost exclusively on grouse, poultry, rabbits, etc., and is very destructive.

Buteo borealis *(Gmel.).* **RED-TAILED HAWK.**

A common species, resident in southern Wisconsin, though much more numerous during spring and fall migrations. Nests in all sections of the state, even in quite thickly settled localities. Commonly called "chicken hawk" or "hen hawk," but in no wise as destructive a bird as is generally supposed.

Buteo borealis kriderii *Hoopes.* **KRIDER'S HAWK.**

This western-plains race of the red-tail is a regular fall and spring visitant in western Wisconsin, in small numbers. Mr. J. N. Clark has kindly loaned us a very fine and typical specimen shot by himself at Meridian, Dunn County, October 22, 1892. He states that it is of regular occurrence there in spring and fall, though by no means common. Three specimens, all perfectly typical, have been taken at Lake Koshkonong during the past few years, one of which is preserved in the collection of the Oshkosh Normal School.

Buteo borealis calurus *(Cass.).* **WESTERN RED-TAIL.**

Of rare, but regular occurrence in Wisconsin in the late fall. Six or eight specimens were procured about Lake Koshkonong by Thure and L. Kumlien; one specimen, taken in November, 1873, was pronounced by Prof. Baird as "extra dark" and perfectly typical. A single specimen was taken at Delavan, October 19, 1901. Mr. J. N. Clark has loaned us an extra fine female shot by himself at Meridian, Dunn County, October 25, 1893. This specimen is of solid dark color, with the exception of the reddish-brown blotch across the breast, and has an exceptionally bright reddish tail, crossed by ten black bars and with a wide black terminal band. This specimen is probably very much like the one mentioned by Coues (1) as "chocolate-brown, with a great reddish blotch on the breast."

Buteo lineatus *(Gmel.).* **RED-SHOULDERED HAWK.**

In the early days this hawk was considered a common species by nearly all observers. At the present time it is certainly by no means a common bird in Wisconsin, and at any distance from Lake Michigan seems to be decidedly rare. Appears to nest irregularly at different places, most often at points not far from Lake Michigan. Mr. Clark has taken but one specimen in Dunn County, April 27, 1891, and considers it a very rare species there. Grundtvig failed to find it in Outagamie County, or Willard in Brown County. Mr. W. E. Snyder records but one capture from Dodge County (2). But few have been taken at Koshkonong since 1870, and we have but one specimen from Delavan.

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1. Key to N. A. Birds, Fourth Ed. p. 545.
2. Bull. Wis., Nat. His. Soc. II, 2, p. 110.

Buteo swainsoni *Bonap.* **SWAINSON'S HAWK.**

Although this hawk is very common to the northwest of us — in Minnesota and Dakota — it is not a common species in Wisconsin. Dr. Hoy apparently met only the young, which he called *vulgaris*, and later described as a distinct species, under the name of *B. bairdii*, a mounted specimen remaining so labeled in his collection to this day. Mr. J. N. Clark has procured but a single specimen, in December, 1896, in Dunn County. Grundtvig did not secure a specimen in Outagamie County, and Willard does not include it in his list of Brown County birds. King calls it a "summer resident," on what authority we do not know, as he apparently did not procure a specimen. Thure Kumlien procured perhaps a dozen specimens during his long period of collecting at Lake Koshkonong, and half as many more have been taken by L. Kumlien. Here it has been noted only during the autumnal migrations, in September and October. Probably occurs more frequently along the Mississippi River than in the eastern or central parts of the state.

Buteo platypterus *(Vieill.).* **BROAD-WINGED HAWK.**

In eastern Wisconsin rather a common spring migrant, and especially common in fall. By no means a common nesting species, but is a summer resident and breeds from the southern tier of counties northward. In Dunn County Mr. Clark considers it on the whole an uncommon species, but has seen and taken it a number of times. According to our observations, this is the hawk that "flocks" in the fall, ofttimes in great numbers. Occasionally several hundred may be seen at a time, often ten to twenty in one tree. These migrations seldom last but a day or two and are of irregular occurrence. Other authorities speak of these "hawk flocks" being made up of all the smaller species in general and the red-shouldered in particular, but our observation has been that the flocks are invariably of this species alone.

Archibuteo lagopus sancti-johannis *(Gmel.).* **AMERICAN ROUGH-LEGGED HAWK.**

Very common migrant, and, unless the weather be too severe, a common winter resident in southern Wisconsin An occasional specimen is found as late as the middle of April, but rarely later, although there are records of individuals remaining through the summer. In May, 1872, a pair of these hawks was found nesting in the eastern part of Dane County by L. Kumlien. The nest was placed in a low bur oak, about eight feet from the ground, and contained three eggs, well incubated. This set was sent to Dr. Brewer. The female had been wounded, the primaries of one wing sticking straight up, even when the bird was sitting. She could make but short flights and this is in all probability the cause of the pair remaining here to breed, and it must be considered as an exceptional record. Extremely variable in plumage.

Archibuteo ferrugineus *(Licht.)*. **FERRUGINOUS ROUGH-LEG.**

On November 10, 1893, a pair of these hawks was procured by L. Kumlien at Lake Koshkonong. They were flying low over the rushes a short distance from shore, and one was secured with each barrel. October, 1894, another was taken at the same locality and came into our possession. We are positive of having seen the species in the western part of the state, but the above are the only records of capture obtainable for Wisconsin. These birds are preserved in the Kumlien collection.

Aquila chrysaëtos *(Linn.)*. **GOLDEN EAGLE.**

Rather a rare bird in Wisconsin. Obtained principally from October to March, though there are several records for southern Wisconsin both earlier and later. During the past fifteen years we have handled about fifteen specimens taken at various localities throughout the state. Dr. Hoy records the nesting of this species in a large oak tree between Racine and Milwaukee in 1851, and had the egg in his collection some years ago. To us, however, the egg looked very similar to that of the bald eagle. This eagle is exceedingly variable in size. The Museum of Milton College contains perhaps the greatest extremes extant, one a gigantic female which fiercely attacked a man who was carrying a deer upon his back, in Chippewa County, the other, a male, less than thirty inches in length. During the winter the golden eagle resorts to any carcass of a dead horse or cow that has been left exposed and are then easily secured. We have the details of several instances where it has been suddenly surprised while feeding, and instead of retreating, as might be expected, has turned and fiercely attacked the intruder, sometimes with such vigor as to drive an unarmed man away.

Haliæetus leucocephalus *(Linn.).* **BALD EAGLE.**

The summer resorts about our lakes have gradually driven this species from its former nesting haunts. Bred about Lake Koshkonong twenty-five years ago; one nest at least, or the same tree, had then been occupied by the birds for over twenty years. In southern Wisconsin at the present day the eagle is mainly a spring and fall migrant about the inland lakes, but specimens are occasionally seen in mid-summer. Still nests, not rarely, in Vilas County and in many of the sparingly settled portions of the northern part of the state. The young birds move southward some time in advance of the adults. Not at all rare along the Mississippi, but seems to prefer to nest in the vicinity of inland lakes.

Falco peregrinus anatum *(Bonap.).* **DUCK HAWK.**

Of regular occurrence during the migrations, both spring and fall, principally along the water courses. Was never very common in any part of the state that we can learn. Formerly bred at Racine, and has been known to remain at Lake Koshkonong through the summer. Mr. Clark has taken it in Dunn County, but considers it "rather uncommon." We have seen it in summer along the south shore of Lake Superior, where it appeared to be nesting on the rocky ledges. We have several times had this hawk swoop down and pick up a duck we had just shot before we could reach it. It frequently kills a duck too large and heavy to carry to the shore, and in this case secures a firm hold in the duck's back, and flying, drags it along on the surface of the water to the shore.

Falco columbarius *Linn.* **PIGEON HAWK.**

A rather common migrant during the latter part of April, generally through May, and again during September and October. At the present time a rare summer resident in southern Wisconsin, but it not infrequently remains in the central and northern parts of the state. Dr. Hoys speaks of its nesting near Racine in 1852. Grundtvig called it abundant in Outagamie County in 1882-3. We have found it fairly plenty in several sections of the northern part of the state. Considering the large numbers seen, and even procured, it is remarkable that so few are in the full blue plumage. A perfect falcon in every sense of the word, with all the boldness, daring and dexterity of its larger relatives.

Falco richardsonii *Ridgw.* **RICHARDSON'S MERLIN.**

A migrant only in Wisconsin, and not noted by us except in autumn. We have two specimens from Stevens Point and have taken it several times during the past ten years at Lake Koshkonong. Does not arrive until some time after the pigeon hawk, which is probably accounted for by the fact that it breeds much farther from our lines than that species. Our latest fall record is November 29 (1896). Several specimens were taken by Thure Kumlien, but as he did not consider it specifically distinct from *columbarius* a reference to his notes is of little value in the present connection. A fine specimen in Mr. Skavlem's collection was shot near Janesville in the late fall of 1886. This species is usually readily distinguished from the preceding by its slightly larger size, its conspicuously banded tail—the latter crossed by six distinct ashy-white bands—the amount of ochraceous brown markings on primary coverts, and withal its much lighter color in any plumage. We often get specimens however, which appear to be intermediate, or at any rate not typical of either, and hard to determine.

Falco sparverius *Linn.* **AMERICAN SPARROW HAWK.**

Common summer resident, especially in heavily wooded regions. Where the larger trees are cut away it is far less common during summer than formerly. So far as we are able to learn the sparrow hawk is found in all parts of the state, but more commonly in the heavily timbered hardwood districts.

Pandion haliaëtus carolinensis *(Gmel.).* **AMERICAN OSPREY.**

Summer resident in all suitable localities in the state, but not common anywhere. Noted more frequently in autumn, September to November, on the larger lakes and rivers. More plenty in the Rock River Valley and thence eastward to Lake Michigan, than in the western part of the state, except along the Mississippi River. Summer resorts, with all the attendant features, have driven the fish hawks from many of the smaller lakes where they formerly bred. A specimen was found washed ashore on Lake Koshkonong, in June, 1898, with both feet firmly imbedded in the back of a very large carp; the fish had proved too large for the hawk, and he had weakened in the struggle and drowned.

FAMILY STRIGIDÆ: BARN OWLS.

Strix pratincola *Bonap.* **AMERICAN BARN OWL.**

Although Wisconsin is rather far north for this species, specimens are occasionally taken, especially in the southern half. Dr. Hoy records it from Racine; one specimen was taken at Pine Lake in the forties; two or three have been taken in Jefferson County at an early day; and one specimen in the Whitewater Normal School was taken near that city in 1899. Mr. F. F. Pierson, of Janesville, mounted a specimen shot near that place in the winter of 1901-02. It is also noted from La Crosse and Ripon (1). The only authentic breeding record we have for the state is furnished us by Mr. H. H. T. Jackson, of Milton, who saw in Green County in April, 1899, a live female with three eggs, which had been taken from a hollow bur oak tree.

FAMILY BUBONIDÆ: HORNED OWLS, ETC.

Asio wilsonianus *(Less.).* **AMERICAN LONG-EARED OWL.**

Formerly a very common resident. In such localities as furnish thick shelter, tangled underbrush and dense thickets, and undisturbed spots, it is yet quite common. More strictly nocturnal than the next. In southern Wisconsin almost invariably makes use of a last year's crow's nest, to which is added a lining of various materials, and in this part of the state two broods are often reared in a season.

Asio accipitrinus *(Pall.).* **SHORT-EARED OWL.**

More common, at least locally, than formerly. In prairie and marshy regions a very common fall migrant, to a less extent a winter resident, and not infrequently remains throughout the summer and breeds, even in the southern counties. The species has been known to nest at Delavan, Albion, Stoughton, Stevens Point, and more commonly (?) in the north and north-central parts of the state. Is commonly seen hunting over the marshes on cloudy days, and during the nesting season is frequently noted about at any time, often sailing high overhead like a hawk. Except, perhaps, during the nesting time, when it feeds the young largely on birds, it is very beneficial, existing almost entirely on mice, grasshoppers, etc. A

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1. Cooke, Bird Migration in the Miss. Valley, U. S. Dept. Agriculture, 1888, p. 121.

nest found at Delavan, May 29, 1898, contained three young, of different sizes, and afforded a rather surprising lesson as to the destructiveness of this species to smaller birds during the breeding season. The young were probably ten to fourteen days old, and were literally resting on a mass of wing and tail feathers of the victims of their appetites. From this mass we picked out over six hundred feathers, and at the bottom of the nest the feathers were so mouldy and mixed with grass that no attempt was made to count or identify them. From those in a good state of preservation and reasonably fresh we positively identified the following varieties, all entirely unexpected, as we had always looked upon this species as pre-eminently a mouse and insect eater: *Icterus galbula*, *Galeoscoptes*, *Hylocichla*, *Toxostoma*, *Vireo*, *Cistothorus*, *Piranga erythromelas*, *Agelaius phœniceus*, *Dolichonyx*, *Lanius!* (one nearly entire tail), *Seiurus aurocapillus*, *Dendroica æstiva*, *Geothlypis trichas*, *Setophaga ruticilla*, *Coccyzus*, *Regulus* (2 tails), *Porzana carolina*, *Porzana noveboracensis*, *Actitis macularia*, *Ægialitis vocifera*, *Spiza americana*, *Antrostomus vociferus* (at least two), *Sialia sialis*, *Zamelodia ludoviciana*, *Sturnella magna*, *Pipilo erythrophthalmus*, tyo species of small *Tyrannidæ*, and among the large number of wing and tail feathers of warblers were *Dendroica maculosa*, *D. blackburniæ*, *D. cærulescens*, and *D. rara*, as well as others of this family, and several species of sparrows it was impossible to determine. No trace of a mammal was found either about the nest or in the pellets around it.

Syrnium nebulosum *(Forst.)*. **BARRED OWL.**

Resident, but of irregular distribution. Like a number of other birds, both residents and migrants, this owl prefers such localities as have not undergone much change from the wild state. Where the woods have been too much cut away and the larger trees removed, it is no longer common. In the tracts that have not been disturbed, however, the barred owl is, perhaps, with the exception of *Megascops*, the commonest owl in Wisconsin. A common nesting species about Delavan, and northward in all suitable localities. We have never known this species to nest in other situations than the hollows of trees, with the exception of one nest placed on the top of a broken stub, only twelve feet high. In this case, however, it was reasonable to suspect that the nest had already been occupied before the tree had broken off.

Scotiaptex cinerea *(Gmel.).* **GREAT GRAY OWL.**

Rare winter visitant. This great owl seldom reaches southern Wisconsin, especially of late years. Before the heavy timber was cut down specimens were sometimes known to reach even the southern tier of counties. Recorded by Dr. Hoy from Racine in 1848. Two specimens were sent Thure Kumlien from Bark River woods, Jefferson County, at about the same time. We have received two specimens from Iron River, taken in November, 1891. Deer hunters from the northern counties sometimes bring down specimens; probably half a dozen reached Thure Kumlien from this source during many years. If we could trust reports from hunters and residents in the Lake Superior region we would say that it is not rare in winter in that section, particularly during severe weather.

Nyctala tengmalmi richardsoni *(Bonap.).* **RICHARDSON'S OWL.**

A very rare visitant in southern Wisconsin during winter. Probably occurs more frequently in the northern part of the state. Dr. Hoy records a single specimen taken at Racine, November 30, 1850. Thure Kumlien procured three or four specimens in Dane and Jefferson counties during nearly fifty years residence in these parts. L. Kumlien has taken two, one in Dane County, 1869, and one at Fort Atkinson, August, 1872. Mr. J. N. Clark, of Meridian, Dunn County, took one specimen February 24, 1893, at that place, capturing it in his hands from the side of a straw stack. One specimen (no record) is preserved in the Milwaukee Public Museum.

Nyctala acadica *(Gmel.).* **SAW-WHET OWL.**

This little owl is most often found in Wisconsin in winter, but this is when food is scarce and it consequently comes about barns and dwellings, and is more frequently seen. It certainly used to breed in Jefferson County and Thure Kumlien took specimens in May, and at least once in August. For some reason it is not as common as formerly. Dr. Hoy, writing in 1852, considered it common at Racine, and it was known to breed there. Some of his specimens of *Nyctala kirtlandii* (= juv. *acadica*) were hatched near that place. Willard also claims it as a breeding bird for Brown County. Mr. Clark considers it rare in Dunn County. In the Copeland-Russel collection in Milwaukee are four specimens, three from Iron County, September and October, 1898, and March, 1899, and one from Waukesha County, November 19, 1897. During the winter of 1889-90 two specimens remained about the barns on the Kumlien homestead at Milton all winter. The larger of these, presumably the female, hunted a great deal during the day time, and became an expert sparrow catcher. Its mate did not seem nearly so expert, yet he did not go hungry as it was a common sight to see both owls feeding from the same sparrow. These birds became very tame, so that one could almost put his hands upon them.

Megascops asio *(Linn.).* **SCREECH OWL.**

Common resident, more so apparently in settled portions of the state than away from civilization. Nests even in villages and towns of some size, wherever it finds hollows that will serve as nesting sites. Though naturally subsisting largely on mice it becomes a great sparrow catcher when living about towns and farm houses. One of our most beneficial birds, but, unfortunately, its usefulness is not universally recognized.

Bubo virginianus *(Gmel.).* **GREAT HORNED OWL.**

Resident. With the disappearance of the heavy timber this owl has gradually become less and less common in the south and central parts of the state. In well wooded regions it is still locally common, and clings to such patches of timber as have escaped the general destruction. Usually more plenty in the hardwood timber of bottom lands along streams, or banks of lakes. Supposedly resident wherever found, but there appears to be some southward migration late in fall and during severe winters. Breeds as early as the middle of February. Wisconsin specimens are exceedingly variable in color, ranging from very dark birds to specimens so light as to almost pass for ***pallescens.***

Bubo virginianus arcticus *(Swains.).* **ARCTIC HORNED OWL.**

A rare winter visitant, at least in southern Wisconsin. Taken by Hoy at Racine and by Kumlien at Lake Koshkonong, both at an early day. A fine specimen, preserved in the Milwaukee Public Museum, was procured at Ashland, January, 1886. Mr. Witmer Stone has examined the type of Hoy's ***subarcticus*** from Racine and states that it is a typical ***arcticus.*** The ***subarcticus*** of most authors (but not of Hoy) is renamed by him ***pallescens.*** This form has been credited to Wisconsin, probably through error in mistaking Hoy's ***subarcticus*** as the same bird as the ***subarcticus*** of later authors.

Intermediates are common in Wisconsin in winter, but Mr. Stone thinks they are more likely intermediates between *virginianus* and *arcticus* than between the former and *pallescens*. The western horned owl may, however, occasionally straggle to our southwestern borders.

Nyctea nyctea *(Linn.)*. **SNOWY OWL.**

Winter visitant, of irregular occurrence. Some winters the snowy owl is quite common, straggling to the very southern portions in some numbers, and again not a specimen is recorded. A bird of the prairie and large marshes rather than of the thick woods, and consequently found more often along Lake Michigan and the Lake Superior shores than in the interior. Rev. A. C. Barry, 1854, speaks of it as frequently remaining in Wisconsin in summer, which is *very* doubtful even of that day. Thure Kumlien knew of two such cases, but the birds each time proved to be "cripples," having been slightly wounded and unable to return with the breaking of spring. Perfectly sound specimens were secured, however, in April on several occasions, and one as late as May 5 (1847). Frequently appears in southern Wisconsin as early as the middle of October, but more often from late November to mid-winter. Can hardly be considered as nocturnal, as it hunts over the marshes all day like a hawk. When these owls reach Lake Koshkonong during open water they persistently hunt along the edge of the rushes for wounded ducks, and at times, apparently from choice, as other food is plenty, will catch fish. Does not occur in nearly as great numbers as formerly, and at the present time has developed a degree of sagacity equalled only by the sand-hill crane or golden eagle.

Surnia ulula caparoch *(Müll.)*. **AMERICAN HAWK OWL.**

A very rare winter visitant in southern Wisconsin; more frequent in the northern part, especially of late years. Recorded from Racine by Dr. Hoy and from the same place by Thure Kumlien, who received a specimen from there killed in the winter of 1869. Several were also taken about Lake Koshkonong at an early day. Mr. J. N. Clark has taken the hawk owl twice at Meridian, in April, 1885, and in December, 1900. In the winter of 1892 we received three specimens from Bayfield County. A specimen in the Milwaukee Public Museum is labeled "Fox Point, Milwaukee, Wis."

ORDER PSITTACI: PARROTS, MACAWS, PAROQUETS, ETC.

FAMILY PSITTACIDÆ: PARROTS AND PAROQUETS.

Conurus carolinensis *(Linn.).* **CAROLINA PAROQUET.**

Many years ago the paroquet occasionally wandered to southern Wisconsin. Dr. Hoy, in 1852, somewhat vaguely refers to it as "formerly common on the Mississippi River, within the state, latterly seldom met with." Thure Kumlien saw a considerable flock near Lake Koshkonong in 1844 or 1845. One specimen which he secured at this place at an early day was sent to John G. Bell, of New York. In the Kumlien collection is a fine specimen, taken in Waukesha County in 1844, which is probably the only Wisconsin specimen extant (1). Nelson, in 1876, refers to the taking of specimens in northeastern Illinois, by Robert Kennicott (probably in the fifties), and states that others were seen in the vicinity at an early day.

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ORDER COCCYGES: CUCKOOS, ETC.

FAMILY CUCULIDÆ: CUCKOOS, ANIS, ETC.

Coccyzus americanus *(Linn.).* **YELLOW-BILLED CUCKOO.**

A regular summer resident from the southern tier of counties to at least beyond the middle of the state, and sparingly still farther north. Not nearly so common in most sections as the next, and rather irregularly distributed. In some districts it is even more common than the black-bill, this being especially true in parts of the extreme southern counties at least. It is a common occurrence to find young of different ages in the same nest, and even young nearly ready to fly and fresh eggs together. Appears to be more numerous than thirty-five years ago. A rather late arrival in spring—often not before the 20th of May—it departs for the south by the end of August. Often confounded with the next, which seems inexcusable.

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1. Cook's "Birds of Michigan," 1893, makes the mis-statement that I have taken a specimen of the paroquet in Jefferson County, Wisconsin. This probably refers to one taken by my father many years before, as I have of course, never seen the bird in the state.—L. Kumlien.

Coccyzus erythrophthalmus *(Wils.)*. **BLACK-BILLED CUCKOO.**

A summer resident; rather hardier than the yellow-billed, arriving earlier and remaining later; more common than that species also and more regular in distribution. From data at our command this species seems to range much farther north than the preceding and not to be so closely restricted to certain localities and certain kinds of timber. We have watched a pair of these birds, returning from day to day, eat and carry away the hairy caterpillars as fast as they left the web nest, in a small wild plum tree. We have found the eggs of one of the species of cuckoo, at least, in nests of the catbird, brown thrasher and rose-breasted grosbeak, but have never seen the young cared for by foster parents.

FAMILY ALCEDINIDÆ: KINGFISHERS.

Ceryle alcyon *(Linn.)*. **BELTED KINGFISHER.**

A common summer resident. Arrives in southern Wisconsin about the first of April, and remains until the ice forms. Mr. Wm. H. Bennetts writes us of an individual which remained through the winter. An interesting bird, whose life history has been but slightly touched upon. A careful study of the habits and every day doings of the kingfisher has many surprises in store for the careful observer.

ORDER PICI: WOODPECKERS, ETC.

FAMILY PICIDÆ: WOODPECKERS.

Dryobates villosus *(Linn.)*. **HAIRY WOODPECKER.**

Resident, common, but not nearly as abundant as the downy woodpecker. Not particularly a bird of the pine timber, it breeds from the southern tier of counties northward in hardwood sections as well. Commoner in southern Wisconsin in winter.

Dryobates villosus leucomelas *(Bodd.)*. **NORTHERN HAIRY WOODPECKER.**

Dr. Hoy and Thure Kumlien took specimens of this variety in the early days in both Racine and Jefferson Counties. Up to 1875 it was a regular visitor in winter in the tamarack swamps in north Jefferson County. During the past ten or fifteen years not a specimen has been taken and hairy woodpeckers collected in winter and late fall in northern Wisconsin have all proved to be typical *villosus*. More information regarding its recent occurrence and distribution in Wisconsin is desirable. To be looked for in severe winters along our northern border, especially. The hoary whiteness is a more pronounced character even than the larger size.

Dryobates pubescens medianus *(Swains.)*. **DOWNY WOODPECKER.**

Resident. Common at all seasons, but more plenty in summer than in winter, in this respect the opposite of *villosus*. Fully as common as thirty years ago. Competent observers, as Grundtvig, in his "Birds of Shiocton," speak of this species nesting at heights of thirty feet or more. This is decidedly at variance with the habits of the bird in southern Wisconsin, where it is a common nesting species, the nest being rarely more than ten or twelve feet, often only four to six, and in one instance just twenty-six inches above the ground.

Picoides arcticus *((Swains.)*. **ARCTIC THREE-TOED WOODPECKER.**

Common in the pine regions of the state during late fall and winter. Before the growth of heavy tamarack was cut in the many swamps of portions of southern Wisconsin it was abundant in such localities as far south as Fort Atkinson in winter. Rarely taken in other timber than pine or tamarack, and of late years it seldom visits southern Wisconsin. This species undoubtedly breeds in the northern part of the state, as there are several records of specimens taken during summer months. We have seen it at Merrill and near Wausau in June, and near Oconto (several specimens) in early August. Thirty to forty years ago it impressed one as being almost gregarious, such large numbers were found in a very small area of dead tamarack. These trees seem to contain insect larvæ of which the birds are particularly fond.

Picoides americanus *Brehm*. **AMERICAN THREE-TOED WOODPECKER.**

Rare winter visitant. Records of this woodpecker for Wisconsin are very few. From 1860 to 1870 several specimens, about a dozen all told, were taken by Thure and L. Kumlien in the large tamarack wood near Jefferson. Dr. H.

V. Ogden and Dr. E. Copeland have taken two specimens in Iron County, a male and a female, taken, respectively, Sept. 30 and Sept. 25, 1898, and preserved in the collection of E. Copeland and H. Russel at Milwaukee; and it has been reported from the upper peninsula of Michigan by Mr. H. Nehrling. It is certainly a decidedly rare bird in central or southern Wisconsin at the present day, but doubtless occurs each winter in the extreme northern pine woods.

Sphyrapicus varius *(Linn.).* **YELLOW-BELLIED SAPSUCKER.**

Abundant migrant and regular summer resident. Arrives in southern Wisconsin from the last of March, through the month of April. In autumn the migration extends from September 15 to October 15. Summer resident from near the southern tier of counties northward, sparingly southward and more commonly farther north. Breeds in considerable numbers about Lake Koshkonong, always in "bottom land" timber, maple, elm and ash, usually, if not always, excavating a cavity in a green tree. Spring males show a great variation in the amount and distribution of the red, both on throat and head. Apparently has not decreased in numbers during the past thirty-five years.

Ceophlœus pileatus abieticola *Bangs.* **NORTHERN PILEATED WOODPECKER.**

With the disappearance of heavy timber this species has gradually been driven from sections where it was formerly common. Going back to 1870 and earlier, it was not at all an uncommon bird in Bark River woods in Jefferson County, where it bred regularly as late as 1872, and sparingly even later. No doubt the same thing is true of all the once heavily timbered sections of the state. One was shot in Jefferson county in 1877, in late fall, the last record for the section. One was seen in Walworth County in May, 1889. In the central and northern parts of the state it is still fairly common, especially in the heavily timbered hardwood districts. Probably resident whereever found, though individuals sometimes wander considerable distances out of their usual range. We received a specimen in October, 1898, which had been killed by a boy with a "slingshot" in Lincoln Park, Chicago. Several years ago a specimen was taken alive in a room of the upper story of a house in Milwaukee. It had apparently crawled in at the open window. Two specimens have been picked up on the lake shore at

Milwaukee, having no doubt become bewildered and perished in the lake. Generally known as "wood-cock," or "log-cock" by deer hunters and people living in the timber regions. Except in the entirely unsettled parts of the state has become exceedingly wild and wary.

Melanerpes erythrocephalus *(Linn.).* . **RED-HEADED WOODPECKER.**

Very common summer resident and of late years to a considerable extent resident. Few birds have so modified their habits in the past forty years as this species. Twenty-five years ago it was a rare thing to find one in winter; at the present time that is a common occurrence. Perhaps more interesting are the curious nesting sites selected in order to conform to the changed surroundings. Instead of being restricted more or less to rather open groves of heavy timber it is now found almost everywhere, in the largest cities and on the widest prairies. Among some of the odd nesting sites we have noted are the following: Between two flat rails on an old style rail fence; the hub of a broken wagon wheel, leaning against a fence; the box of a grain drill left standing in a field; a hole excavated in the hollow cylinder of an ordinary pump; common in fence posts and telegraph poles. These were usually in prairie regions where there were few, if any, suitable trees. The red-head has to a marked degree the habit of the genus *Melanerpes* of hiding or hoarding food, acorns, corn, various nuts, etc., in cracks and crevices in the bark of trees, along fences, etc., but it does not always utilize these hoards.

Melanerpes carolinus *(Linn.).* **RED-BELLIED WOODPECKER.**

Not a common species anywhere in Wisconsin. Our observation has been that it inhabits heavy bottom land timber, maple, ash, etc., in preference to oak. Probably nearly resident wherever it occurs in the state, as it certainly is in Jefferson, Dane and Rock Counties, it being, if anything, more common in suitable localities here in winter than in summer. Dr. Hoy noted that it remained all winter at Racine. Grundtvig found it in winter in Outagamie County in 1883, and Willard took specimens in Brown County in February and April. Mr. J. N. Clark has procured but four specimens in sixteen years collecting in Dunn County—one male was seen in November. The eggs have been taken several times in Jefferson County, where the nesting sites were always in large dead trees overhanging water, and generally at a considerable height, and very hard to reach. Mr. W. E. Snyder records three specimens from Dodge County—in June, October, and November. We took a single specimen in Milwaukee County in May, 1882, but in no part of the state have we ever found it as plenty as along the bottom lands of Koshkonong Creek, Jefferson County.

Colaptes auratus luteus *Bangs.* **NORTHERN FLICKER.**

A very common summer resident in all parts of the state. This is especially true of the older settled sections. Arrives in southern Wisconsin from the middle of March to the first week in April, according to the season, and though the greater portion have left for the south by the middle of October, a few are found a full month later. Less common in the heavy pine regions. In sections where suitable trees are scarce, this species will sometimes bore a hole in the gable end of a clapboard house and deposit its eggs on the first convenient cross timber between the board and plaster. One instance which came to our notice was where an opening was made in the loft of a barn, and the eggs simply deposited on some hay in one corner, several feet from the hole. An ant-eating, ground-feeding species, very different in habits from the rest of the woodpeckers. We have taken two specimens in southern Wisconsin, which show a slight tendency toward the red-shafted. One male in the Kumlien collection, Milton, Wis., May 10, 1892, has a very liberal sprinkling of scarlet in the usual black "moustache," besides some minor intermediate characters.

ORDER MACROCHIRES: GOATSUCKERS, SWIFTS, ETC.

FAMILY CAPRIMULGIDÆ: GOATSUCKERS.

Antrostomus vociferus *(Wils.).* **WHIP-POOR-WILL.**

This bird was formerly a very common summer resident in all thickly wooded sections of the state, and is still locally common wherever there is thick underbrush, or in such places as have not been pastured or burned over. It usually arrives in southern Wisconsin from the first to the tenth of May, and leaves for the south early in September. Nearly all observers who have favored us with reports speak of its rapidly diminishing numbers, except in such sections as have been but slightly disturbed from a state of nature. Found the entire length of the state, but is generally more common in the hardwood districts than among the pines.

Chordeiles virginianus *(Gmel.).* **NIGHTHAWK.**

A common summer resident. The nighthawk is one of those species which have changed their habits to conform with the state of civilization. Thirty years ago a common breeder on any gravelly or sandy knoll or hill, often in cultivated fields and pastures, and even on the sandy shores of lakes. At the present time is as common in the towns as in the country, breeding on the flat roofs of buildings, even in the larger cities. The immense autumnal flights, formerly a regular feature of the fall migrations, are becoming less regular, and although still locally common, are a mere fraction of what they once were. Large numbers of these useful birds are yearly slaughtered by a certain class of "sportsmen" (?), for "practice." We are at a loss for words to express our supreme disgust at this abominable practice; still it is in perfect keeping with the average intelligence of many of this particular class, and we only hope that our feeble protest will be read by some "prominent" person who considers it legitimate sport to kill and main these exceedingly useful birds by the hundred. Not being "game birds" the game wardens are disposed to overlook this criminal practice, and thus the slaughter goes on from year to year.

Chordeiles virginianus henryi *(Cass.).* **WESTERN NIGHTHAWK.**

On returning from a visit to the Douglass Bros., at Waukegan, Illinois, at the time that Messrs. Nelson, Rice and Douglass (1) had firmly established the presence of *C. v. henryi* at that place, I found three specimens in the Kumlien collection. One of these, sent to Dr. Coues, was pronounced typical *henryi.* Two specimens were later secured by Thure Kumlien in September, 1880. Since that time we have not taken a specimen, the nearest approach being a few intermediates. Probably found as an irregular migrant, especially in fall, throughout western and southwestern Wisconsin, and possibly rarely as a breeding bird.—L. K.

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1. Nelson, Birds of N. E. Illinois, p. 114.

FAMILY MICROPODIDÆ: SWIFTS.

Chætura pelagica *(Linn.).* **CHIMNEY SWIFT.**

An abundant summer resident. The chimney "swallow" has been steadily increasing in numbers during the past fifty years. At the present time it nests almost entirely in chimneys, but in some sections still breeds in large hollow trees.

FAMILY TROCHILIDÆ: HUMMINGBIRDS.

Trochilus colubris *Linn.* **RUBY-THROATED HUMMINGBIRD.**

The little ruby-throat is a common summer resident in all suitable localities throughout the state. It arrives early in May, sometimes before it really should attempt to brave our climate, and numbers often perish from the late frosts. Some are already migrating by the last of August, but many linger until well along toward the last of September.

ORDER PASSERES: PERCHING BIRDS.

FAMILY TYRANNIDÆ: TYRANT FLYCATCHERS.

Muscivora forficata *(Gmel.).* **SCISSOR-TAILED FLYCATCHER.**

The only record of the occurrence of this bird in Wisconsin is that of the single adult male taken by L. Kumlien near Milton, Rock County, October 1, 1895. The bird was perched on a fence by the roadside, and was shot as it flew away. Although a cold, blustering day, it seemed entirely at ease, and was in perfect condition, being very fat. The specimen is preserved at Milton.

Tyrannus tyrannus *(Linn.).* **KINGBIRD.**

This familiar bird is an abundant summer resident from the last of April until early in September. First arrivals of different years in southern Wisconsin have been from April 20 to May 2, and the latest seen from August 26 to September 2. It nests from May 20 until late in June, often rearing two broods.

Tyrannus verticalis *Say.* **ARKANSAS KINGBIRD.**

An adult female of this species was shot near Albion, Dane County, June 11, 1877. It was apparently not breeding. The bird was perched on a fence by the roadside, and was shot under the impression that it was a great crested flycatcher, a species which the collector was anxious to secure. We are not aware of any other record of the capture of this bird in Wisconsin. The specimen is now preserved in the Museum of Milton College.

Myiarchus crinitus *(Linn.).* **CRESTED FLYCATCHER.**

The crested flycatcher is not an uncommon summer resident and regular breeder in most parts of the State. Grundtvig found it nesting in Outagamie County, and Mr. Clark reports it as a regular summer resident, but not abundant, in Dunn County. In the southern part of the state, about Delavan and Milton, it is a rather common species, nesting in the heavy timber. It appears from the south the second week in May, and departs early in autumn.

Sayornis phœbe *(Lath.).* **PHŒBE.**

Abundant summer resident. Adapting itself to the inroads of the summer visitors among its favorite breeding grounds, there is hardly a lake cottage which does not have its phœbe's nest under the veranda or eaves. The first of the flycatchers to arrive in the spring, we have noted it as early as March 19, and have found it abundant on March 30, though usually not so until the forepart of April. It remains with us until nearly October 1 (last dates, Delavan, September 20, 26, 30). Two broods are often reared, the nesting season commencing very early, and occupied nests are common up to July 1.

Sayornis saya *(Bonap.).* **SAY'S PHŒBE.**

Accidental straggler. The only authentic record that gives this species a place in the list is that of Dr. Hoy, who took at least one specimen at Racine. The actual date of capture seems to have been lost, and as the Hoy collection is now entirely without data we are unable to find it. Aside from our personal knowledge, of at least the one specimen, the record is given by Nelson, Grundtvig and King, the latter noting that "Dr. Brewer states that one specimen was obtained by Dr. Hoy near Racine, and sent to Mr. Cassin for identification" (1).

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1. F. H. King, "Economic Relations of Wis. Birds. Geol. of Wis., I, 1873-9, p. 560.

Contopus borealis *(Swains.)*. **OLIVE-SIDED FLYCATCHER.**

Rather a rare but regular migrant. More common during the latter part of May than in the autumn, when it appears sparingly for a short time from the last of August on. Breeds along Lake Michigan from Sheboygan northward, and doubtless in other sections of the state. Specimens have been taken at Lake Koshkonong as late as June 10, often to June 2 and 3. We think this species is more common than generally supposed. When one has learned where to look for it, it can always be found during the migrations. Will usually be found on the topmost dead branch of a tree higher than the surrounding ones, from which elevated perch it constantly darts out, frequently to great distances, after insects.

Contopus virens *(Linn.)*. **WOOD PEWEE.**

The most abundant and generally distributed of the flycatchers throughout the summer, nesting in almost every piece of woods. Arrives the last of April, or early in May (April 28 to May 5), and remains until late in September (last dates September 13, 20, 27, 28). It often rears at least two broods, nesting commencing the first of June, and young unable to fly may still be found in August.

Contopus richardsonii *(Swains.)*. **WESTERN WOOD PEWEE.**

Rare, straggling summer resident. Several typical western wood pewees have been taken at Lake Koshkonong. One pair, with nest and eggs, were identified by Dr. Coues as unquestionably of this species. Not reported by other observers at any point in the state, and we can add nothing to the above bare facts. Doubtless careful watching will prove its presence rarely at other localities within our boundaries.

Empidonax flaviventris *Baird*. **YELLOW-BELLIED FLYCATCHER.**

Not as rare in Wisconsin as early writers have made us believe, the yellow-bellied flycatcher is a regular migrant and rare summer resident. A rather late arrival in the spring it is usually not present until May 15 to 30. Thure Kumlien took a nest with four eggs in the Bark River woods, Jefferson County, June 7, 1860, and two nests at a later date in 1863 and 1864. A nest was found by L. Kumlien in a tamarack swamp near Albion, Wisconsin, June 25, 1891. This nest contained two young just hatched, and one egg. Mr. F. H. King obtained a specimen at Worcester, July 26, 1876, which would lead one to believe that it bred in that locality, as it probably does, rarely, in other parts of the state.

Empidonax traillii *(Aud.)*. **TRAILL'S FLYCATCHER.**

As Mr. Wm. Brewster suggests, this form is probably an uncommon or perhaps accidental visitor of Wisconsin during migrations. A specimen taken at Delavan, August 1, 1897, has been identified by Mr. Brewster as typical *traillii*. Perhaps occurs as a regular summer resident in parts of southern and southwestern Wisconsin, but more specimens of the group will be necessary to satisfactorily determine its range and abundance.

Empidonax traillii alnorum *Brewst.* **ALDER FLYCATCHER.**

A tolerably common summer resident. It arrives from the middle to the last of May, and is most conspicuous during late July and August in open, willowy marshes, often far from timber. Mr. Brewster has kindly examined our small series of this group and pronounces the birds of late May and June typical *alnorum*, suggesting that this is no doubt the breeding form. He writes that "it is interesting to find typical examples of the two forms in the same locality." As noted under the last, more specimens of the *traillii* group will have to be examined before an accurate knowledge of their respective abundance in Wisconsin can be expected.

Empidonax minimus *Baird.* **LEAST FLYCATCHER.**

An abundant summer resident over the entire state, and like the pewee, is found nesting during early and mid-summer in all suitable localities. It sometimes arrives as early as April 12, but not commonly until the first of May (April 30 to May 5), and all leave us in September. A constant associate of the redstart and red-eyed vireo in thick second-growth oak woods, especially in the vicinity of water.

FAMILY ALAUDIDÆ: LARKS.

Otocoris alpestris *(Linn.)*. **HORNED LARK.**

Found on the prairies during winter, ofttimes in considerable numbers. The birds representing this race of the horned lark reach the southern part of the state late in fall, and leave us early in spring. We have never known anything approaching typical *alpestris* to have been taken in Wisconsin in summer. It does not occur anywhere, under our observation, except on the larger prairies, while *praticola* is found in almost any field or pasture, even when quite small and surrounded by woods. Usually found associated with the Lapland longspur, arriving and departing with the latter. It averages so much larger than the prairie horned lark as to be readily recognized.

Otocoris alpestris praticola *Hensh.* **PRAIRIE HORNED LARK.**

This is the common, resident horned lark of Wisconsin, and is an abundant breeding species in all suitable localities. Frequently nesting as early as the middle of March, two broods are reared in a season. Breeding birds from northwestern Wisconsin show a considerable variation from those of the southern part of the state. In extremely cold weather in midwinter this form sometimes almost wholly disappears for a very short time.

Otocoris alpestris hoyti *Bishop.* **HOYT'S HORNED LARK.**

We have long mistrusted *O. a. arenicola* Hensh. as an occasional late fall or winter visitor to Wisconsin, and since the publication of Mr. Oberholser's "Review of the Larks of the Genus Otocoris" (1) have carefully gone over our series from many parts of the state. We find, as a consequence, no less than three perfectly typical specimens of *O. a. hoyti*, all procured in winter in Rock County, from large flocks of *alpestris*. The birds are doubtless of rare, but regular occurrence as late fall stragglers in many open prairie sections of the state.

FAMILY CORVIDÆ: CROWS, JAYS, MAGPIES, ETC.

Pica pica hudsonica *(Sab.).* **AMERICAN MAGPIE.**

Rare winter visitant. The magpie was doubtless formerly of more frequent occurrence in Wisconsin than during recent years. Dr. Hoy states that two were shot at Caledonia in December, 1848, and one was obtained at Bailey's Harbor, on Lake Michigan, November 15, 1849, by a gentleman from Racine. Mr. J. N. Clark, of Meridian, writes us that one was captured in a trap in Dunn County in 1870, and that he himself saw one in the same locality, at close gun range, in February, 1884. In the winter of 1859-60, Thure Kumlien made a number of ineffectual attempts to shoot a specimen that came daily to feed on some hog offal, that had been hung upon a neighbors

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1. Proc. U. S. Nat. Mus., XXIV, pp. 801-884.

fence when butchering. He saw the bird plainly on two or three occasions when he did not have a gun. This was in Jefferson County. A specimen was also taken near Ashland in 1880. Deer hunters from northern Wisconsin report seeing specimens, but very rarely. During severe winters they are sometimes seen about lumber camps. A pine-land hunter, with whom we were acquainted, said he had seen perhaps a half dozen in all his experience of many years in northern Wisconsin.

Cyanocitta cristata *(Linn.).* **BLUE JAY.**

Abundant throughout the entire year over the greater part of the state. One of the most familiar of birds; as much at home in towns and cities, as in the deepest woods. More common in the settled portions of the south and central parts of the state than in the pine region.

Perisoreus canadensis *(Linn.).* **CANADA JAY.**

Common and very familiar about the logging camps of northern Wisconsin during winter. Apparently does not extend its migration far outside of the pine regions, especially at the present time. It has been taken at Racine (Hoy), near Jefferson (T. Kumlien), and Janesville, but many years ago. There does not seem to be very good evidence that it is a summer resident in any part of the state; still it would not be at all surprising if it should be found nesting. Commonly known as "Whiskey Jack," and "camp-robber."

Corvus corax principalis *Ridgw.* **NORTHERN RAVEN.**

Steadily decreasing in numbers, but yet rather a common species in the less settled portions of northern Wisconsin. Dr. Hoy, in 1852, gave it as more numerous than the next at Racine. It has always been considered as more common along Lake Michigan than in the interior, except in the northern part of the state. Nelson found it a rare winter visitant in northeastern Illinois in 1876, but states that it was formerly "not an uncommon resident." King gives it as "common the whole length of the Flambeau River, October and November, 1877, several seen daily." Willard reports but one specimen from Brown County, and Gruntvig one from Outagamie County, in 1882. Grundtvig, on the authority of residents, states that it was formerly common in that county. Thirty to forty years ago the raven was not a rare winter visitant to southern

Wisconsin, but of late years it is rarely seen. A single specimen shot at Lake Koshkonong, November, 1891, by L. Kumlien, and mounted for Albion Academy, is the last real record we have, although others have been "seen." We have met it at several points in northern Wisconsin in late fall and winter, but more often along Lake Michigan and Lake Superior than elsewhere. It is really common at several points along Lake Superior, where it seems to replace the crow entirely. It is commonly found around the lake fishing stations.

Corvus americanus *Aud.* **AMERICAN CROW.**

Very abundant in the southern part of the state, it has gained in numbers at a wonderful rate, especially during the past fifteen years, notwithstanding the incessant warfare that has been carried on against it by the farmers and sportsmen. Indeed, the crow was formerly considered as not a common bird at all in southern Wisconsin, and the increase has been constant to a certain extent for the past fifty years. Dr. Hoy, in 1852, considered it one of the rarest of birds about Racine. At the present time it is not as common along Lake Michigan as in the interior, but is much more abundant than formerly. In north and north-central Wisconsin the crow is not a winter resident, though it is apparently extending the line farther and farther each year. At Stevens Point, for instance, it is migratory, and a common summer resident. Mr. Clark writes that in Dunn County it has become an abundant summer resident, and is more of a pest to the poultry raisers each year. A few winter here, Mr. Clark states. In the southern counties it nests early in April, and remains, in increased numbers, during the winter, forming immense roosts at intervals. At dusk it flocks in great numbers from miles around to these winter "crow roosts," leaving again in every direction, for the feeding grounds, at break of day.

Nucifraga columbiana *(Wils.).* **CLARKE'S NUTCRACKER.**

A specimen of Clarke's crow was shot by Mr. Hawley, in the western outskirts of Milwaukee in the late fall of 1875. The bird was too badly shot to make a good skin and it came into the possession of Dr. G. W. Peckham, who made a skeleton of it himself. The specimen, with the exact date, etc., was later destroyed by the disastrous high school fire in that city, in which Dr. Peckham lost his entire valuable osteological collection. There is not, however, the slightest possible doubt of the authenticity of the record; it is well remembered by our older ornithologists, and Dr. Peckham vouches for it himself.

FAMILY ICTERIDÆ: BLACKBIRDS, ORIOLES, ETC.

Dolichonyx oryzivorus *(Linn.).* **BOBOLINK.**

An abundant summer resident, arriving the first of May, and breeding in large numbers in all suitable places. One of the first of the summer visitors to leave us in the autumn, and all are often gone by the 20th of August, but in exceptional years it is common as late as that date in September, and has been taken even later. These tardy birds, however, appear to be migrants from farther north, and not the ones which nest with us. The first arrivals in spring are still partially in the winter plumage, and all have fully acquired this dress before again leaving in the fall.

Molothrus ater *(Bodd.).* **COWBIRD.**

Unfortunately for many of the nesting birds, particularly vireos, warblers and native sparrows, the cowbird is a common summer resident, and well indeed must their nests be hidden if they are to be safe from the alien egg. The list of species imposed upon is a very long one, in fact no variety, unless it be much larger or of entirely different habits, seems to be exempt. It arrives early in April, and departs, usually, in August. The cowbird is, without question, increasing steadily in numbers.

Xanthocephalus xanthocephalus *(Bonap.).* **YELLOW-HEADED BLACKBIRD.**

A summer resident. In some sections of the state the yellow-head seems to be totally absent, while on certain lakes it breeds abundantly. The species is apparently becoming more common in many localities where it was once almost unknown.

Agelaius phœniceus *(Linn.).* **RED-WINGED BLACKBIRD.**

A very abundant summer resident. One of the first birds to arrive in the spring, it remains until extreme cold weather—a few even wintering in mild seasons—in southern Wisconsin. Nests in all low places, weaving the nest in the grass, placing it on a bog, bush or even in a low tree. It begins flocking from August 10 to 20, and at this time becomes very destructive to corn in the milk, entire fields being sometimes ruined when situated near a lake or marsh. From the time the red-wing begins to flock until it leaves for the south, it invariably roosts in the reedy marshes, toward which localities it returns in great numbers about sunset. Albinistic specimens are common and we have seen two or three specimens with a pink crescent on the breast, as well as an adult male with no red on wings. It is very variable in size, and a large series of fall migrants, especially, would probably produce specimens of *Agelaius p. fortis* Ridgw., the thick-billed red-wing. It has not appreciably decreased in numbers during the past forty years.

Sturnella magna *(Linn.)*. **MEADOWLARK.**

An abundant summer resident, it is occasionally found at any time of the year, even in the severest of winter weather. Not so plenty in southern Wisconsin as thirty-five years ago. Many are shot by would-be sportsmen, and suitable nesting sites are fewer and restricted in size. For nesting grounds the birds prefer the virgin sod to cultivated fields. In Dunn County, Mr. J. N. Clark tells us, it appears to be giving way in numbers to the western form, *neglecta*, which is slowly increasing in that region.

Sturnella neglecta *Aud.* **WESTERN MEADOWLARK.**

In many parts of the state the western meadowlark breeds more or less commonly. Dr. Hoy had a specimen, identified by Baird, which he captured at Racine as late as December 24. He also mentions its occurrence on the lake shore at other times in early winter. Mr. F. H. King found it breeding in St. Croix County (1). In Dunn County it is a regular summer resident and breeds. As stated under the preceding it is slowly increasing in numbers there. Mr. H. Russel, and Drs. Copeland and Ogden have found it in Milwaukee County. It is found regularly in Rock, Jefferson and Dane counties, but only (?) in very late fall, November and even December, not having as yet been noted in spring or summer.

Icterus spurius *(Linn.)*. **ORCHARD ORIOLE.**

In the southern part of the state this oriole is a regular, and not a rare summer resident, more often nesting in and on the edges of towns, in quiet places, than in the country. Mr. Clark finds it a common breeding bird in Dunn County, and writes

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1. Econ. Rel. Wis. Birds, Geol. of Wis., 1883.

that two pairs nest every year in his yard. The bird is certainly more common in southern Wisconsin than formerly, and sometimes even reaches the shores of Lake Superior. We cannot resist venturing the opinion that this species has gradually extended its summer home northward.

Icterus galbula *(Linn.).* **BALTIMORE ORIOLE.**

A common, or sometimes almost abundant summer resident, the "golden oriole," or "hang nest" is known to everyone as one of our handsomest village birds. It nests anywhere in the larger trees along the streets and about the lawns of our towns, and even in the country seems to prefer the immediate neighborhood of a farm house as a place to build its nest. One male was known to return to the Kumlien homestead five years in succession, with a mate, and build its nest on the same limb each year. This bird was accustomed to answer a certain note on the flute, and seemed happy to try and imitate different flute notes. It is not our purpose to go into details in regard to habits of birds, but the Baltimore oriole certainly possesses more "brains" than any other of our native species, as numerous instances we could cite would show. We have yearly been in the habit of furnishing the nesting materials for birds breeding about the house, and have varied the material until we have a collection of nests of many different fibrous substances.

Scolecophagus carolinus *(Müll.).* **RUSTY BLACKBIRD.**

An abundant migrant. This hardy species now pushes farther north to nest, and, returning late, is one of the last of the transients to leave us, remaining until the ice forms, and the sloughs freeze for the winter. Dr. Hoy writes of a few remaining through the summer (1852). Formerly quite a number were summer residents in southern Wisconsin even, but only a single instance of its nesting is on record. A set, nest and eggs, taken at Storrs' Lake, near Milton, June, 1861, is now in the Kumlien collection. We have several times seen specimens of either this species or the next in the western and northwestern part of the state in summer, but as they were observed from the car windows it is not safe to say which they were.

Scolecophagus cyanocephalus *(Wagl.).* **BREWER'S BLACKBIRD.**

Wisconsin is probably the extreme eastern limit of the breeding range of this species, and the only known instance of its nesting in the state was at Lake Koshkonong, June 14,

1862. Two or three specimens, besides these, have been taken at the same locality in the past sixty years. No doubt of more regular occurernce in the western part of the state. It is easily overlooked among the great numbers of the foregoing species: in fact all the specimens taken, excepting the breeding birds, were procured by accident in flocks of *carolinus*. King (1) says "met with rarely in the eastern portion of the state, but as it occurs regularly in Minnesota it may be found along the Mississippi." He procured a "single mature male, in July, on a large marsh just east of Princeton, Green Lake County." Nelson records it as "a rare visitant in company with the preceding," in northeastern Illinois in 1876.

Quiscalus quiscula æneus *(Ridgw.).* **BRONZED GRACKLE.**

An abundant summer resident. The "crow blackbird" arrives early, and nests throughout most of the state. It flocks in the summer as soon as the young are able to fly, and deserts its nesting grounds for the orchards and fields. Remains until late in the fall, often, in small numbers, until late in November. Of late years the grackle has taken to nesting in parks of cities and villages, and in the larger private grounds, until it is a prominent feature about our towns. Away from the towns it sometimes nests in cavities in trees, constructing a complete nest, however, in these holes. It readily takes to a large, deep box in a tree for a nesting site.

FAMILY FRINGILLIDÆ: FINCHES.

Hesperiphona vespertina *(Coop.).* **EVENING GROSBECK.**

A common winter visitant, usually found in good numbers any time from December on. Most frequent, however, during the latter part of the winter, in February and March, and sometimes remaining in the vicinity of favorite feeding trees until late in the spring. It has been taken in Jefferson County as late as May 20 (1891), and Dr. Hoy notes it for Racine as late as May 15. In the northern counties it is, of course, much more abundant, and although formerly very erratic and uncertain is of late years a regular winter resident. Different observers have for the past twenty-five years given their observations on this species until the subject is almost exhausted. Unquestionably the bird has gradually extended its usual range

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1. Geol. Wis., 1873-79, p. 551.

eastward and southward, until at the present time it is anything but rare in southern Wisconsin, where thirty to forty years ago it was almost unknown.

Pinicola enucleator leucura *(Müll.).* **CANADIAN PINE GROSBEAK.**

The pine grosbeak is a common winter bird in northern Wisconsin, and at irregular intervals it pushes its way to the southern counties, sometimes in good numbers wherever there are plenty of its favorite buds and berries. It is often supposed, and usually so written, that the appearance of this and the last species in the southern part of the state depends entirely on the severity of the weather; but this does not always seem to be the case as they are almost as frequently seen after prolonged spells of mild weather throughout the state as after an unusually cold snap, or a series of storms. Like the evening grosbeak, this species is much more regular and common every winter than during former years. It is said to nest within the boundaries of the state; but we are unable to substantiate this and think it very doubtful.

Carpodacus purpureus *(Gmel.).* **PURPLE FINCH.**

In most sections of southern Wisconsin a more or less common migrant in spring and fall, but very irregular in its occurrence. Dr. Hoy speaks of a few nesting about Racine fifty years ago. It has been known to remain through the summer in Jefferson County, but nests were not found. Grundtvig (1) found it nesting in Outagamie County in 1883, several pairs being noted. Mr. J. N. Clark states that the purple finch is "a regular migrant in Dunn County, but have never seen it in summer." He thinks it very doubtful if it nests in that part of the state. Noted at Delavan only as an irregular spring and fall migrant. We have seen it at Milwaukee, Two Rivers, Sturgeon Bay and Merrill in summer, where it was no doubt nesting. Dr. Hoy speaks of its nesting on Lake Superior, and we have evidence to show it to be a summer resident in Iron County. Apparently very erratic, not only as regards migration, but also in selection of summer homes.

Loxia curvirostra minor *(Brehm.).* **AMERICAN CROSSBILL.**

A regular and sometimes very abundant winter visitant in all parts of the state, though in some seasons not at all common

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1. Birds of Shiocton, Trans. Wis. Acad. Sciences, Arts, and Let. X-p. 126.

in southern Wisconsin. Nests irregularly in the north central parts of the state, and formerly as far south as Dane County. Young just able to fly were procured in a cemetery at Albion in August, 1869. Ofttimes remains about Stevens Point until well into summer. We have met it at various points in northern Wisconsin in summer and have procured young, barely fledged, in April in Iron County. Of a considerable number of Wisconsin crossbills sent Mr. Wm. Brewster for examination, a large percentage of the northern specimens were identified as *Loxia c. bendirei* Ridgw., and some specimens from southern Wisconsin (Walworth County) were determined as nearer *bendirei* than *minor*.

Loxia leucoptera *Gmel.* **WHITE-WINGED CROSSBILL.**

A winter visitant. This species is often common in north and central Wisconsin, and irregular flights have been noted at different points in the southern counties for the past fifty years. Mr. Clark writes that in Dunn County it is sometimes found with the common crossbill, but more often keeps in small flocks of its own kind only.

Acanthis hornemannii exilipes *(Coues).* **HOARY REDPOLL.**

An irregular winter visitor: rare. During January, February and March, 1896, Mr. J. N. Clark found these birds tolerably common in Dunn County. He writes: "In the winter named we had an unusual flight of redpolls from the first of November until late in March, but the hoary did not appear until January. They were nearly all found in one small field, situated at the top of a high hill, and well covered with pig-weed, upon which they fed. They were in small flocks, accompanied by a few of the common variety. I took over thirty specimens of *exilipes* during the three months." Mr. Clark has kindly sent us a series of redpolls from his locality for examination. Dr. Hoy noted but a single instance of their occurrence at Racine (December, 1850), but Thure Kumlien recognized them as distinct as far back as 1848, and took them a number of times during severe winters at Lake Koshkonong, where they have been taken at different times since. The last record for Rock County was in January, 1895. Specimens have also been received from Iron County and Shawano. They may be readily recognized in flocks of *linaria* by their lighter color.

Acanthis linaria *(Linn.).* **REDPOLL.**

An abundant winter visitant. In the southern part of the state the redpoll, like others of the northern birds which appear only in winter, is of irregular and uncertain occurrence, though usually found in good numbers at different times during the season. In the northern counties it is almost always an abundant visitor from late fall until spring, and seems to be especially plenty at certain localities, as about Stevens Point. Has been noted in Jefferson County as early as October 28 (1869). The early arrivals are always young birds, the full plumaged adults not becoming numerous until cold weather.

Acanthis linaria holbœllii *(Brehm.).* **HOLBŒLL'S REDPOLL.**

A rare winter straggler. One specimen was shot at Lake Koshkonong, January 22, 1867 (L. K.), and identified by Prof. Baird in 1881. In a series of redpolls taken during January, February and March, 1896, by Mr. J. N. Clark at Meridian, are four specimens easily referable to this race. Mr. Clark has kindly sent one of these to us for examination, which has been marked as *holbœllii* by Ridgway and Fisher, who identified a number of redpolls for him at the time. These specimens were taken singly during the three months from flocks of the other varieties. The difference can be readily seen when compared with a series of *linaria* and *rostrata* without measurements, and the very pronounced slender bill and robust size, as well as other characters, distinguish this from both the other races.

Acanthis linaria rostrata *(Coues).* **GREATER REDPOLL.**

Winter visitant. Mr. Clark collected over thirty of these birds in Dunn County during the winter of 1895-6. Regarding this variety he writes: "The greater redpolls kept, as a rule, in small flocks by themselves, accompanied by a few of the common ones only, and were nearly always found in the low timber lands along the river bottoms. Their food appeared to be the seeds of the water pepper almost exclusively." A series sent us by Mr. Clark at the time, in the flesh, all proved to be of this variety, and specimens of this and the other races were identified for him later by Prof. Robert Ridgway. Specimens have also been received from Stevens Point and Iron County, and others have been taken quite regularly at Lake Koshkonong, especially during winters of heavy snowfall. Here they have never been found except as associated with *linaria*.

Astragalinus tristis *(Linn.).* **AMERICAN GOLDFINCH.**

The goldfinch is an abundant summer resident, and is found in fair numbers at any time during the winter. It is more numerous during the spring migration, in May, however, than at any other time. It nests commonly in mid-summer, and even as late as September.

Spinus pinus *(Wils.).* **PINE SISKIN.**

Of very erratic occurrence in southern Wisconsin, it is most common during early autumn. Usually quite common about Lake Koshkonong at this season and has been noted here and at Delavan a number of times in spring. Much more common in the northern part of the state, abundant at times in some sections. Dr. Hoy supposed it to nest in the pine regions, which may be true. Grundtvig says: "Was certainly seen in flocks April 7, 1883, and the following days. None shot (Outagamie County). It is said to breed in Wisconsin as far south as Jefferson County (Cooke). Many were shot at De Pere in March, 1883 (Willard)." Mr. J. N. Clark has taken it only in October and November in Dunn County, and considers it a very unusual bird there. King says: "Ordinarily it is only a winter resident. A few may breed in the state." Personally we have never taken it in the state in summer.

Passer domesticus *(Linn.).* **HOUSE SPARROW.**

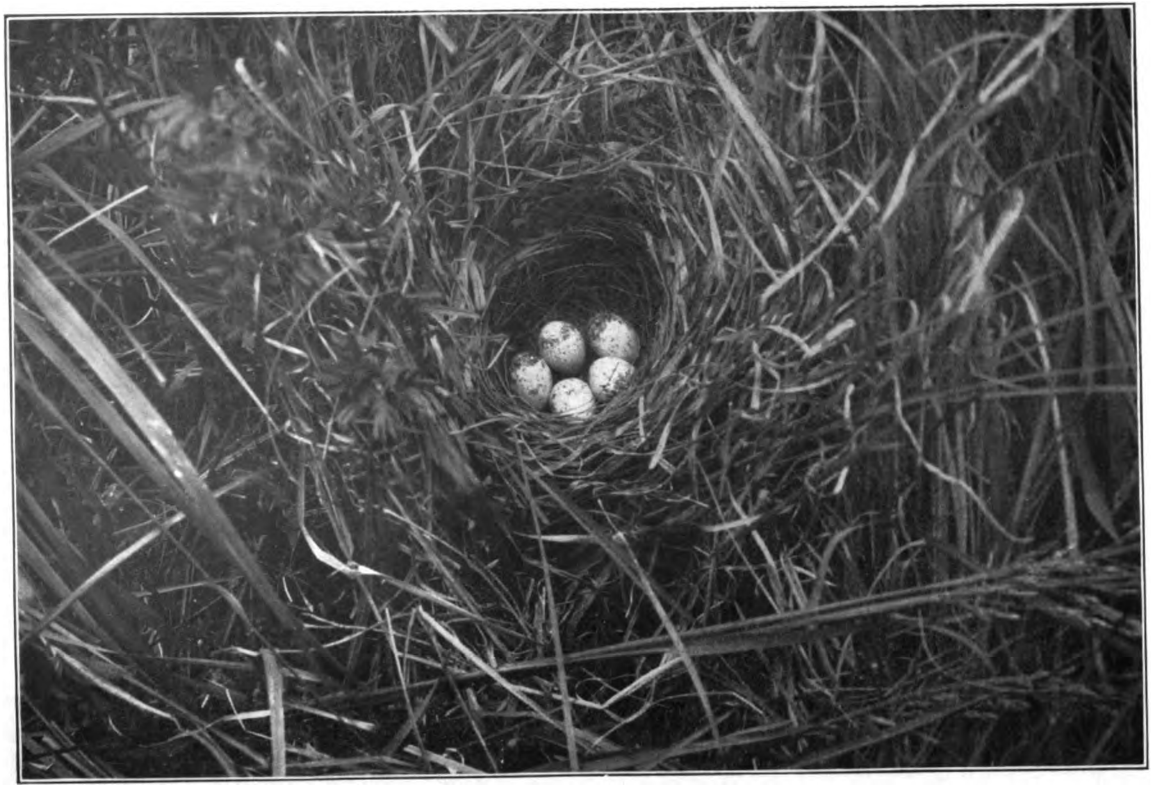
Abundant resident. Introduced, and has spread over nearly the entire state.

Passerina nivalis *(Linn.).* **SNOWFLAKE.**

A regular winter visitant, sometimes appearing in great numbers, at any time from October on until spring. Its favorite resorts are open fields, prairies, and lake shores, alighting on the beaches and bars, and running about like flocks of sandpipers. The first arrivals are always the young birds, the adults not taken until later. Full plumaged winter adults are not often taken in southern Wisconsin. For some reason not apparent it is much less numerous than formerly. Less severe winters and a lighter snow fall may be the sole reasons.

Calcarius lapponicus *(Linn.).* **LAPLAND LONGSPUR.**

A regular and abundant winter bird, ecpecially on the prairies. It arrives earlier in the fall and remains much later in the spring than the snowflake, with which it is often associated in winter. The longspur is in breeding plumage and full song



NEST AND EGGS OF HENSLOW'S SPARROW.

Photo. by F. E. BURROWS.

before it leaves southern Wisconsin in May. Often taken as late as May 10, and even May 16. We have one adult male shot on Rock Prairie, Rock County, on June 2. It is fully as common as thirty years ago.

Calcarius pictus *(Swains.).* **SMITH'S LONGSPUR.**

This longspur cannot be classed otherwise than as rare and of extremely erratic occurrence in Wisconsin. Dr. Hoy met with considerable numbers prior to 1852. Although we have looked for it very carefully on the prairies among the common longspurs we have found it but a few times, and never in flocks of any size. Presumably the migration is from the northwest and they merely cross the southern counties of Wisconsin in fall, as they are not at all rare on the prairies of Illinois in winter.

Poœcetes gramineus *(Gmel.).* **VESPER SPARROW.**

The vester sparrow is one of the most abundant of roadside birds the entire summer, nesting wherever there is sufficient grass to cover its eggs. It arrives the first of April, and for a short time is found, as often in the south, in the woods, but on the approach of the nesting season it forsakes the trees for the open fields and pastures.

Passerculus sandwichensis savanna *(Wils.).* **SAVANNA SPARROW.**

An abundant summer resident. Arrives early in April, and is common by the latter half of the month. Nests on the dry marshes and prairies, but in the fall is a common bird about the ponds and lakes, in flocks, spending much time among the rushes, over shallow water.

Coturniculus savannarum passerinus *(Wils.).* **GRASSHOPPER SPARROW.**

Common summer resident over most of the state. Like some others of the genus the grasshopper sparrow appears to nest in scattered colonies. In the breeding season one may go for miles without seeing an individual of the species, and then suddenly find it abundant, a male on nearly every fence post.

Ammodramus henslowii *(Aud.).* **HENSLOW'S SPARROW.**

Until recently our only knowledge of the occurrence of this seclusive species in the state was based on the capture of six specimens near Milton. The first of these, a male, was taken in the fall, about 1870; two in September, 1892; and three during September, 1894. On May 29, 1897, we were together collecting on a large, dry marsh near Delavan, and found it abundant and evidently nesting. Many specimens were taken in all stages of plumage during the summer and fall, and each succeeding year we have found it equally abundant; but although we have taken many young still unable to fly more than a few feet and yet in nestling feather, as well as specimens in the post-juvenal moult, we have been able to find but one nest. This was taken May 29, 1898, and contained five eggs. It was placed on the ground in a tuft of grass beside some small willows, within twenty-five feet of a clump of tamarack trees, in one of the dampest places on the marsh. The parent bird was shot as she flew from the nest. The birds seem to remain on this marsh entirely, at least we have never found them anywhere else at any season, except as noted above. They arrive in May, and remain until well into October. During the latter part of August and September the adults especially are in a condition of such extreme moult as to be almost unable to fly, there being many days when not an individual can boast of even a single tail feather. At the height of the nesting season, in June and early July, the males are perched upon the tops of the higher weeds over the whole marsh, but at other times of the year they must almost invariably be flushed from the grass to be seen. Evidently two broods at least are reared as we haye, by the aid of a careful retriever, taken nestlings in September. Mr. W. E. Snyder has recently discovered the species about Beaver Dam, and states that it is "an abundant summer resident in the dryer marshes" (1). It will doubtless be found in many localities in southern Wisconsin, where there are suitable breeding grounds.

Ammodramus lecontei *(Aud.)*. **LECONTE'S SPARROW.**

This species was taken at Lake Koshkonong but three or four times, but always in autumn, from 1842 to 1890 (T. and L. K.). One specimen was taken near Milwaukee in the fall of 1879 (L. K.). In September, 1894, numbers were procured at Lake Koshkonong, and at the same date in 1895 five hundred could have been taken. In 1896 but few were seen, and in 1897 none were procured. Since 1897 but a few each fall could be found. One was taken at Delavan in September,

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1. Bull. Wis. Nat. His. Soc., April, 1892, p. 111.

1900, and others noted. We are at a loss to account for its great numbers in 1895, when a series of sixty skins was secured in two days, and as many more could have been easily taken. It is also rather remarkable that the closest search has failed to produce a single specimen in spring, none having been noted before August. Precisely similar localities to those frequented at Lake Koshkonong have been carefully searched, with a good dog, but without success. One of the most difficult birds imaginable to collect, as it is never seen until flushed, must be shot on the wing, and last, but not least, *found*, after it is killed.

Ammodramus nelsoni *(Allen).* **NELSON'S SPARROW.**

For the past twelve years we have found this species exceedingly abundant about Lake Koshkonong, in September and early October. Here it is always found among the bullrushes growing in the water. Several were noted near Delavan Lake, September 26, 1899, and one taken, by F. E. Burrows. King records one specimen from Cold Spring Pond, Jefferson County, September 7, 1877, and Dr. Hoy took at least one at Racine. Although so very common in fall about Lake Koshkonong we have been unable, as in the case of *leconteii*, to find a specimen in spring or summer. Curiously enough this bird was not detected by Thure Kumlien and others in Wisconsin in early days,and what strikes the writers as still more peculiar is that the same localities where it is now so abundant were *carefully* observed twenty to thirty years ago without finding a single individual of the species. It seems almost impossible that it could have been overlooked, if as abundant at that time as at the present day.

Chondestes grammacus *(Say).* **LARK SPARROW.**

This superb songster is somewhat irregularly distributed in Wisconsin. In most of the less wooded sections of the central and southern part it is a fairly common summer resident, but seems to be entirely absent from some localities. Mr. Clark finds it a common nesting species in Dunn County. Dr. H. V. Ogden and Mr. H. Russel have found it in fair numbers near Milwaukee. Dr. Hoy called it common at Racine, fifty years ago. Formerly quite common about Lake Koshkonong, but of late years has greatly decreased in numbers. The lark sparrow loves the uncultivated sod. Wherever there is an unbroken prairie, if only of limited extent, it is sure to be found.

Much more common in the western, than in the eastern part of the state. In settled districts a frequenter of the roadside, and especially liable to be found in old, grass-grown orchards.

Zonotrichia querula *(Nutt.)*. **HARRIS'S SPARROW.**

Apparently, this bird is becoming more common in Wisconsin than formerly. Mr. J. N. Clark, of Meridian, Dunn County, gives us the most information regarding its occurrence in the state. Some years ago he wrote us as follows: "The first that came to my notice in Wisconsin were taken May 12, 1886, a pair, and I saw no more until October 5, 1890, when three specimens were taken from a bunch of four, and again, October 19, 1892, saw a flock of six or eight, and have seen a few individuals each fall since, but never have found it in the spring, except the time mentioned above. It is a rare bird in this locality, but is becoming more plenty each year." Recently, Mr. Clark wrote again, in answer to our inquiries, that he has found it nearly every fall and spring for the past few years, and has seen it as late as June 1. "It is becoming more common every year," he again states. Still later, the past year, Mr. Clark noted a pair of these birds at Meridian on the morning of July 4 (1902), "near the bank of a wooded stream." "From their actions," he writes, "and the lateness of the season, I think there is not much doubt but that they were nesting near by, but I had not the time then to look for the nest." Dr. Ogden and party found this species in Iron County, taking a specimen from a flock of about twenty-four birds. There is also an old record of Dr. Hoy's of one specimen taken at Racine, and W. W. Cooke (1) mentions a specimen captured at Trempealeau in the fall of 1883. Three specimens have been taken at Lake Koshkonong, one in spring, and two in fall.

Zonotrichia leucophrys *(Forst.)*. **WHITE-CROWNED SPARROW.**

The white-crown is a common migrant, usually in the scattered flocks of white-throats, fox, and other hedge and brush-loving sparrows. It also *nests* very sparingly in the state. Dr. Hoy reported that a few nested near Racine. It was also taken nesting at Cedarburg in June 1882, when two of the five young, barely able to fly, were taken. In 1873 it nested on the north shore of Lake Monona, at Madison, and it has been known to remain through the summer, a number of times, at Lake Koshkonong.

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1. Auk, I, 4, p. 333.

Zonotrichia leucophrys gambelii *(Nutt.).* **INTERMEDIATE SPARROW.**

Rare straggler. A specimen of this variety was taken at Racine, April 20, 1871, by Dr. P. R. Hoy. Specimens have been taken a number of times about Lake Koshkonong which are almost, if not quite, typical *gambelii*. Regarding the Hoy specimen Mr. Nelson (1) says: "The specimen has been kindly loaned me for examination, and is without doubt a perfectly authentic example of the variety. The lores are almost white, considerably lighter than in the average specimen of *intermedia*" (=*gambelii*).

Zonotrichia coronata *(Pall.).* **GOLDEN-CROWNED SPARROW.**

Rare straggler. Several specimens of this western bird were taken by Dr. Hoy near Racine, from 1853 to 1858, both spring and fall. Mr. E. W. Nelson states (Birds of Northeastern Illinois) that he examined one of these, a fine male taken during April, 1858, which had been previously identified by Mr. Cassin.

Zonotrichia albicollis *(Gmel.).* **WHITE-THROATED SPARROW.**

An abundant migrant, and in parts of the state a common summer resident. Nests sparingly even in the most southern counties, but more commonly in the central and northern portions of the state. It seems restricted during the breeding season to favorite localities, where several pairs will be found nesting within a very limited area.

Spizella monticola *(Gmel.).* **TREE SPARROW.**

Abundant migrant and common winter resident. Commonly flocks with the juncos along the brushy roadsides, and often invades the cities and towns, in cold weather, in search of food. March and April, and, later, October and November are the months when it reaches its greatest abundance.

Spizella socialis *(Wils.).* **CHIPPING SPARROW.**

Common summer resident. Before the days of the English sparrow the chippy was an abundant village bird, nesting in almost every yard. Now all is changed, and in most towns it is a rare occurrence for a pair to settle for the summer where it was formerly common. It is still plenty, however, in the country, where it prefers the immediate vicinity of a farm house to the more retired wood.

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1. Birds of Northeastern Illinois, Bull. Essex Inst., VIII, 107.

Spizella pallida *(Swains.)*. **CLAY-COLORED SPARROW.**

An irregularly distributed summer resident, from the southern part of the state northward. From the meager records at hand it seems to be more common in the western part of the state than farther east. Appears to frequent barren, dry and wild places, in marked contrast to ***socialis*** and *pusilla*. Has been taken nesting at Lake Koshkonong, where it occurs as a regular summer resident. More common about Stevens Point than any other locality we know of. Specimens from the sandy pine barrens of Portage County are so different from true *pallida* that Mr. Wm. Brewster thinks they may prove a new race. The lack of a sufficient number of specimens at the present time makes it impossible to settle this point. These specimens are almost as dark as a swamp sparrow.

Spizella pusilla *(Wils.)*. **FIELD SPARROW.**

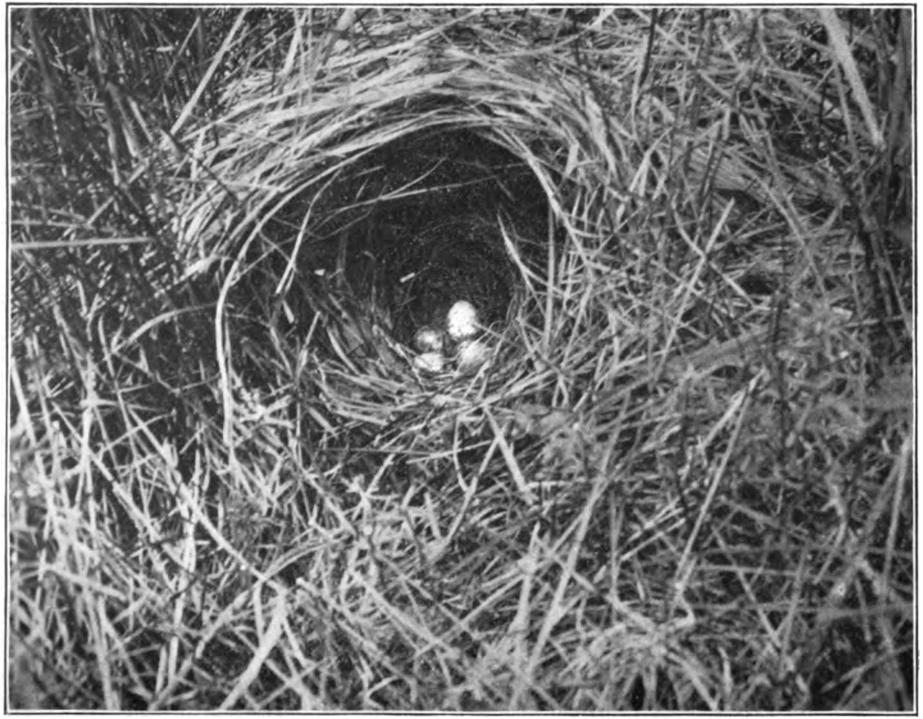
In all suitable places—and these are anywhere that there is a sufficient mixture of brush and open—the field sparrow is an abundant summer bird. Arriving early, remaining late, and rearing two, if not three broods each season, it is one of the most characteristic birds of the woodland border, the open clearings, and the edges of fields.

Junco hyemalis *(Linn.)*. **SLATE-COLORED JUNCO.**

A very abundant migrant and common winter resident. Nests sparingly in northern Wisconsin Three sets were taken at Oconto, in May, 1882 (Coll. of L. K.). The nests were placed on the ground, among sphagnum moss. Dr. Hoy mentions its breeding on the shores of Lake Superior. In rare instances the junco breeds in southern Wisconsin. Young, barely able to fly, have been taken near Jefferson, which is the most southern point for which we have any record, and this must be taken only as an exceptional case.

Junco montanus *Ridgw.* **MONTANA JUNCO.**

A single female of this species was taken at Delavan, October 23, 1898, and is now in the Hollister collection. Mr. Wm. Brewster, who has kindly examined the skin, writes: "This bird matches perfectly a specimen in my collection from Illinois, identified by Mr. Ridgway as typical ***montanus***." Doubtless occurs as a straggling migrant any where in southern



NEST AND EGGS OF SONG SPARROW.

Photo. by F. E. BURROWS.

Wisconsin. The various old records of *Junco oregonus*, *J. o. shufeldti*, *J. h. connectens*, etc., probably belong here.

Melospiza cinerea melodia *(Wils.).* **SONG SPARROW.**

Summer resident. The song sparrow arrives in March, and until late in the fall is an abundant bird. Nests almost anywhere and everywhere, though preferring the immediate vicinity of some creek or spring, where the ground is damp or wet. Specimens have been taken in southern Wisconsin in mid-winter.

Melospiza lincolnii *(Aud.).* **LINCOLN'S SPARROW.**

A somewhat irregularly distributed species, even during the migrations. Nowhere very abundant, but occurs more plentifully than generally supposed. Mr. Clark calls it an irregular migrant, in small numbers, in Dunn County. Dr. Hoy did not consider it rare about Racine, and stated that a few nested. Dr. Ogden reports it rather plenty at Milwaukee. A regular migrant at Lake Koshkonong, especially in spring, and sometimes a summer resident, though no nests have been found. Appears to be rather rare at Delavan and not noted, as yet, except in spring.

Melospiza georgiana *(Lath.).* **SWAMP SPARROW.**

Like its near relative, the song sparrow, this finch arrives early and remains very late in the fall. It is an abundant breeder in all marshy places, and is often found in perfectly dry meadows and lowlands. It is one of the species that are frequently imposed upon by the cowbird.

Passerella iliaca *(Merr.).* **FOX SPARROW.**

A common migrant early in spring, and as late in autumn. Before leaving even the southern tier of counties for the north it is sometimes in full song. Does not seem as plenty as formerly. This shy inhabitant of the brush and cover is one of our most beautiful birds, and it is a great pity it is not of a more sociable nature.

Pipilo erythrophthalmus *(Linn.).* **TOWHEE.**

Summer resident; abundant. This lovely bunting breeds in great numbers in the clearings and open patches of timber. Here on the hottest of summer days its incessant "che-wink" may be heard from all sides, as the birds scratch in the grass and leaves, or dart in and out of the hazel clumps and brushpiles. In some sections much less common than formerly; in others becoming more common.

Pipilo maculatus arcticus *(Sw.)*. **ARCTIC TOWHEE.**

A rare straggler. One specimen, an adult male, has been shot (by L. K.) in Jefferson County. This specimen was sent to Prof. Sundevall, and the record cannot be found at present. There was also a specimen—formerly preserved in the old Wisconsin Natural History Society collection—which was taken near Milwaukee about 1867 or 1868. One was noted by Dr. Hoy in a collection of birds at Dubuque, Iowa, which had been taken on the Wisconsin side of the river.

Cardinalis cardinalis *(Linn.)*. **CARDINAL GROSBEAK.**

Rare. Two specimens were procured at an early day at Lake Koshkonong. Dr. P. R. Hoy is authority for the statement that a few stragglers formerly nested near Racine. Regarding the cardinal Mr. Wm. J. Bennetts, of Milwaukee, writes us: "On February 26, 1900, Mr. F. Kirchner brought me a male he had shot that morning, feeding with the English sparrows near some barns just west of the city. It was too badly damaged to make a skin, but I still retain the head. The same week two birds of this species were mounted by Mr. Bauer, a taxidermist on Chestnut street. I am informed these were taken near the ice houses on the Milwaukee River." One or two other records are supposed to have been of escaped cage birds, but it seems probable that all the above were wandering wild birds, which extended their range a trifle farther north than usual.

Zamelodia ludoviciana *(Linn.)*. **ROSE-BREASTED GROSBEAK.**

This beautiful grosbeak is a common summer resident, and having adapted itself so well to civilization has become a common bird in towns and cities. It seems to have increased in numbers greatly in some parts of the state the past few years, and its well known propensity for destroying the potato beetle, as well as its beautiful plumage and song, should be a guarantee for its protection wherever a pair appears.

Guiraca cærulea *(Linn.)*. **BLUE GROSBEAK.**

A rare straggler in Wisconsin. Thure Kumlien captured a pair near Lake Koshkonong in June, 1860. It was also taken at least once by Dr. Hoy; and there was also a Milwaukee specimen, which seems to have entirely disappeared.

Cyanospiza cyanea *(Linn.).* **INDIGO BUNTING.**

An abundant summer resident, sharing with the little yellow warbler the right to nest in any clump of bushes bordering on, or in the woods. The female is exceedingly shy and retired, but the male loves to sit for hours at the top of some tall tree standing a short distance from the brush, and there repeatedly sing his dainty notes.

Spiza americana *(Gmel.).* **DICKCISSEL.**

A common summer resident, sometimes almost abundant. The dickcissel seems to be a very erratic bird. In some parts of the state it is rather ucnertain or rare, while in other districts it is in certain years really abundant. It was formerly rare in Walworth County, for instance, but in the season of 1901 was one of the most common of roadside birds, a male sitting every few rods along favorable highways. For the past ten years, in this county, the species has been on the increase. Taking the state at large also it is much more abundant generallv than thirty to forty years ago. Two broods are very likely reared in a summer, as we have found eggs in June, and young, only recently from the nest, in September.

FAMILY TANAGRIDÆ: TANAGERS.

Piranga ludoviciana *(Wils.).* **LOUISIANA TANAGER.**

During the latter part of May, 1877, Thure Kumlien found this species nesting within a few rods of the Kumlien homestead in Jefferson County. Nest, eggs and parents were secured, and are now preserved in the Museum of the State University at Madison. The nest was not especially different from that of *P. erythromelas*, and was placed well out on a horizontal branch of a large white oak. This is without doubt the easternmost breeding record for the species, although stragglers are reported even from New England. A second male was procured the next June (1878); and in July, 1891, another, also an adult male, was shot in the same locality by L. Kumlien.

Piranga erythromelas *Vieill.* **SCARLET TANAGER.**

A common summer resident. Arrives early in May in almost perfect plumage, and nests in all suitable woods, seeming to prefer the borders of oak groves, even along the roadside. Like some others of our nesting birds, the tanagers seeem mysteriously to disappear soon after the young leave the nest, and although they remain with us until early fall they are not often seen after the beginning of the post-nuptial moult, having retired to the most secluded woods, where they remain in the thicker tree tops the greater portion of the time.

Piranga rubra *(Linn.).* **SUMMER TANAGER.**

Rare, but evidently a regular summer visitor in southern Wisconsin. It has been taken near Janesville by Mr. H. L. Skavlem; and near Albion, twice at least, by Thure Kumlien. In the Johnstown woods, between Milton and Johnstown, it appears to occur regularly every summer, we having seen it on a number of occasions, and taken specimens. Reported from Racine by Dr. Hoy, and two specimens, taken near Milwaukee, were mounted by local taxidermists, and were formerly in the old Natural History Society collection.

FAMILY HIRUNDINIDÆ: SWALLOWS.

Progne subis *(Linn.).* **PURPLE MARTIN.**

The familiar and generally beloved martin is a common summer resident, nesting exclusively nowadays about buildings, and in bird houses placed for its especial benefit. As lately as 1869 it was still nesting in hollow trees about Lake Koshkonong, and doubtless in other sections. It does not average anywhere near as common as twenty to thirty years ago. Has been driven from many nesting sites by the English sparrow, and many young die in the nest each year for some reason unknown. It arrives from the first to the middle of April, but seems reluctant to settle down to housekeeping, and as a rule it is nearly the first of June before nesting begins.

Petrochelidon lunifrons *(Say).* **CLIFF SWALLOW.**

An abundant summer resident. Nests in colonies of from three or four to upwards of twenty-five pairs, or more, on its favorite barns. Associates constantly, before and after the breeding season, with the barn and tree swallows. It was formerly a very rare bird over some parts of the state where it is now abundant. Fifty years ago it was supposed to ascend the Mississippi and breed at only a few points, whereas at the present time it is abundant the entire width of the state. It was unknown in the early forties in Jefferson County, except as a migrant. Recorded as nesting at Racine for the first time in 1852 (Hoy). In June, 1861, it was nesting in some numbers on barns in Sauk County (Thure Kumlien), and became common in Jefferson County in 1866. In 1845 it was nesting abundantly on the cliffs at Devil's Lake, and twenty years later was still breeding there in less numbers, and more about farm houses than on the cliffs. At the present day it has almost entirely deserted the cliffs, in Wisconsin, and has gradually spread out over all the settled parts of the state, until it is one of our most common swallows.

Hirundo erythrogaster *Bodd.* **BARN SWALLOW.**

This species, although a common summer resident, is not nearly as abundant as the cliff or tree swallow. Seldom nesting in extensive colonies, it prefers to scatter, ordinarily a few, or even a single pair, occupying a building. It arrives about May first, and leaves early in September.

Tachycineta bicolor *(Vieill.).* **TREE SWALLOW.**

An abundant summer resident. The earliest of the swallows to arrive in the spring, numbers of this species are often caught by severe cold snaps, and perish in their vain attempts to procure food enough to sustain life. Many may sometimes be found, along the lake shores, that have fallen exhausted into the water, on these occasions. The tree swallow prefers to nest in the vicinity of a stream or pond, gathering a mass of feathers into some hole or natural crevice in an old stump or tree on which to lay its eggs. It is easily induced to nest in bird boxes, but not being able to cope with the English sparrow, is quickly driven away. Strange as it may seem this species often becomes the foster parent of the cowbird.

Riparia riparia *(Linn.).* **BANK SWALLOW.**

A common summer resident, but appears to be restricted to certain localities as a breeding bird, and its range in the state is very imperfectly known. Many observers who have published notes must have mistaken large numbers of the next for this species. In all our experience we have found the bank swallow nesting in any numbers only along the shores of Lake Michigan, along the Mississippi River, and about some of the larger inland lakes and rivers, where it nests in colonies. It ofttimes occurs in great numbers along Lake Michigan. In the interior it occurs chiefly as a fall migrant, the common nesting "bank swallow" being the next species.

Stelgidopteryx serripennis *(Aud.)*. **ROUGH-WINGED SWALLOW.**

From our observation this is the common breeding "bank swallow" which is found scattered over the most of the state. It is usually found nesting in single pairs, or not more than two to four pairs in a single bank, whereas the foregoing nests in large colonies. In Jefferson, Rock, and Walworth counties the rough-wing is sometimes very abundant, flocking in spring and fall with the other swallows. From the fact that the early lists of Wisconsin birds included this species as very rare, if it was mentioned at all, it has evidently been confounded with the bank swallow by many recent observers, and, therefore, anything like the exact range for either species in the state cannot be ascertained at present.

FAMILY AMPELIDÆ: WAXWINGS.

Ampelis garrulus *Linn.* **BOHEMIAN WAXWING.**

A winter visitant. Formerly much more common than at the present day. If the weather is severe enough the Bohemian waxwing may reach southern Wisconsin by the middle of November, but it is usually later. If the spring is backward it is sometimes noted as late as April. It is especially numerous along Lake Michigan where it feeds largely on the berries of the mountain ash. We have never found it so abundant anywhere as in the cities along the lake shore where this tree has been planted along the streets. We have noted it in great numbers at Ahnapee, Kewaunee, and Two Rivers, and in 1875 it visited Milwaukee by the thousand. It feeds also on the berries of the wild grape, carrion flower and different species of smilax, also on apples, both wild and cultivated. It is generally stupidly tame and unsuspicious. Of much more regular occurrence from the central part of the state northward, also, than in the southern counties, where in fact, it has been rare of late years.

Ampelis cedrorum *(Vieill.)*. **CEDAR WAXWING.**

The cherry-bird, as this species is familiarly known, is another of those birds whose movements are decidedly erratic and uncertain. At a given point it may occur in any month of the year, or be entirely absent at any time. Ordinarily it is a common breeder, nesting in mid-summer.

FAMILY LANIIDÆ: SHRIKES.

Lanius borealis *Vieill.* **NORTHERN SHRIKE.**

A winter visitant, regular, and sometimes common. It usually appears in October. Dr. Hoy claimed that a few spent the summer in the middle and northern parts of the state, and the same idea was entertained by Thure Kumlien fifty years ago. The nearest approach to summer residence we can learn of is the case of a young bird in the brown plumage shot September 6, 1891, in Jefferson County. This bird might have come a considerable distance, however. We are unable to obtain any recent authentic records of its remaining in Wisconsin in summer, and very much doubt that it does. The northern shrike here feeds largely on the mice of the genus *Microtus*, but often catches the smaller birds also.

Lanius ludovicianus migrans *Palmer.* **MIGRANT SHRIKE.**

Summer resident. A very early arrival in spring, often nesting early in April, and again in July. A common bird in open regions, along roadsides and borders of fields, where it nests preferably in isolated, bushy-topped trees. Not as common north of the central part of the state as south of it, except toward the northwest, where it appears to be found more or less to the extreme north portion. We feel that the above name is only provisional, but prefer to include all our smaller shrikes under the one name, rather than to include in this list both *ludovicianus* and *excubitorides* as we should otherwise have to do.

FAMILY VIREONIDÆ: VIREOS.

Vireo olivaceus *(Linn.).* **RED-EYED VIREO.**

An abundant summer resident throughout the entire state. This vireo is one of our commonest nesting birds, although, hiding itself away in the most retired woodlands, as it usually does, it is as little known to the average person as some of our rarest visitors. Here, in any quiet spot, its beautiful song may be heard on all sides the entire summer through. No species appears to be as persistently imposed upon by the renegade cowbird as is the little red-eye; indeed, it is a rare circumstance to find a nest that does not contain one or more eggs of this miserable nuisance.

Vireo philadelphicus *(Cass.).* **PHILADELPHIA VIREO.**

A regular migrant, especially through the eastern half of the state, where it is of rather common occurrence. It is usually found in company with the migrating warblers in May and September. It is much more common during the autumnal migration than in spring.

Vireo gilvus *(Vieill.).* **WARBLING VIREO.**

In some sections of the state the warbling vireo is an abundant summer resident, and one of the most common of breeding birds, while in other less fortunate districts it seems to be confined largely to migrations, although plenty enough then, and appearing in good numbers during late summer. The species is at more at home in the vicinity of dwellings and along the roadsides than its near relatives, nesting, as a rule, in these localities and leaving the deeper woodlands to the equally abundant red-eyed.

Vireo flavifrons *Vieill.* **YELLOW-THROATED VIREO.**

The yellow-throated vireo is a common summer resident in all parts of the state, but by no means so abundant generally as either *olivaceus* or *gilvus*, though exceeding the latter in numbers in some localities. During the migrations, May and September, it is more abundant than at any other time, and is then found everywhere that there are trees, seeming to prefer the open groves to the thicker growths. The nest is one of the most beautifully made of any of our birds, and it is indeed a fine sight to watch a pair of these vireos at work on the little basket-like structure that is to contain the equally exquisite eggs.

Vireo solitarius *(Wils.).* **BLUE-HEADED VIREO.**

A common migrant in May and September, and a regular summer resident in limited numbers. Dr. Hoy reported it as nesting at Racine, and we have noted it as a summer resident at Madison, Two Rivers, Milwaukee and Jefferson. We have, however, found but one nest (Bark River Woods, Jefferson County), and this contained young almost able to fly. It appears to be more common than formerly.

Vireo noveboracensis *(Gmel.).* **WHITE-EYED VIREO.**

A rare summer resident in southern Wisconsin. So few records are obtainable at other points than Lake Koshkonong that we are able to learn but little regarding the distribution of this species in the state. It is doubtful if it occurs, even in limited numbers, much north of this locality, as several competent observers and sharp collectors have failed to find it.

FAMILY MNIOTILTIDÆ: WOOD WARBLERS.

Mniotilta varia *(Linn.).* **BLACK AND WHITE WARBLER.**

An abundant migrant, and tolerably common summer resident. This species is one of the first of the warblers to arrive, appearing in the southern part of the state with the myrtle and palm warblers during the latter part of April. It is common from then until close to the breeding season, when its numbers are greatly diminished. On the southern migration it begins to increase in numbers in August and is again abundant until October.

Protonotaria citrea *(Bodd.).* **PROTHONOTARY WARBLER.**

In suitable localities in the southern and western parts of the state the prothonotary warbler is not a rare summer resident. It was first noted at Lake Koshkonong in 1867, since which time it seems to have become more plenty. Specimens have been recorded from nearly all parts of southern and central Wisconsin. Mr. Clark has so far failed to find it in Dunn County. The northernmost record we are able to obtain is for Shiocton, Outagamie County, May 4, 1882 (1). Apparently more common along the Mississippi than elsewhere in the state. Most observers fail to visit the dense, miry, weed and willow covered overflown swamp lands where this bird makes its summer home. Considerable numbers nest yearly at Lake Koshkonong. In migrations it visits the woods with warbler flocks.

Helmitherus vermivorus *(Gmel.).* **WORM-EATING WARBLER.**

One of the southern species that rarely straggle to Wisconsin. Thure Kumlien procured one specimen at Lake Koshkonong in May, 1873, and one in May, 1877. We have seen a specimen mounted at a taxidermist's shop in Milwaukee which was said to have been taken at that city, and there was no reason to doubt the statement. Dr. Hoy says: "A few nest in this section. Rare." (Racine.) As we remember it he procured but three specimens in all, and knowing it

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1. Grundtvig, Trans. Wis. Acad. Sci., Arts and Let., X, p. 140.

to be a southern species supposed, of course, that it bred, if it occurred there at all.

Helminthophila pinus *(Linn.).* **BLUE-WINGED WARBLER.**

Rare summer resident in southern Wisconsin. One adult female taken by Thure Kumlien June 14, 1867, in the Bark River woods, Jefferson County. One obtained by Mr. C. H. Stoddard, May 7, 1885, at La Crosse (1). Save for these two records the bird was unknown in Wisconsin until July 11, 1897, when we found an entire family, parents and four or five young, and took one of the latter, near Delavan. These had been undoubtedly reared here, but a careful search the next year (1898) produced but a single male, taken May 22. On May 14, 1899, one was seen nest building in the same wood. Three days later the nest, although still unfinished, contained one egg, and a bird was again seen with nesting material in its beak. On the 22nd. the nest was again visited, and the parent shot as she flew from the nest, which now contained six eggs. But one blue-wing had as yet been seen at a time, although the continual "chip, chip" of the mate, the exact call of the one killed (which subsequently proved to be the female) had been frequently heard from the surrounding thicket, while this one was in sight. After a half hour's patient waiting he appeared, and at once showed his deep anxiety and uneasiness at finding us so near the nest. This bird was also shot and proved to be a male Nashville warbler (*H. rubricapilla*) with enormously developed testes. There is not a shadow of a doubt that this bird was the male parent of the clutch of eggs; no one could question that for a moment who had seen his actions at the nest, and although we watched the spot constantly the entire afternoon until nearly dark, remaining hid in the brush, no other bird, Nashville or blue-wing, put in an appearance, nor did we hear a note or call that could have come from either species. Furthermore although collecting in these woods the entire summer not another Nashville warbler was seen short of five miles from the place, and the immediate vicinity of the nest was continually and carefully searched for either species without success. Possibly in our haste to positively identify this rare Wisconsin take, more interesting hybrids between the blue-wing and allied species were destroyed in embryo, as had we known the true state of affairs, the eggs would have been allowed to hatch unmolested

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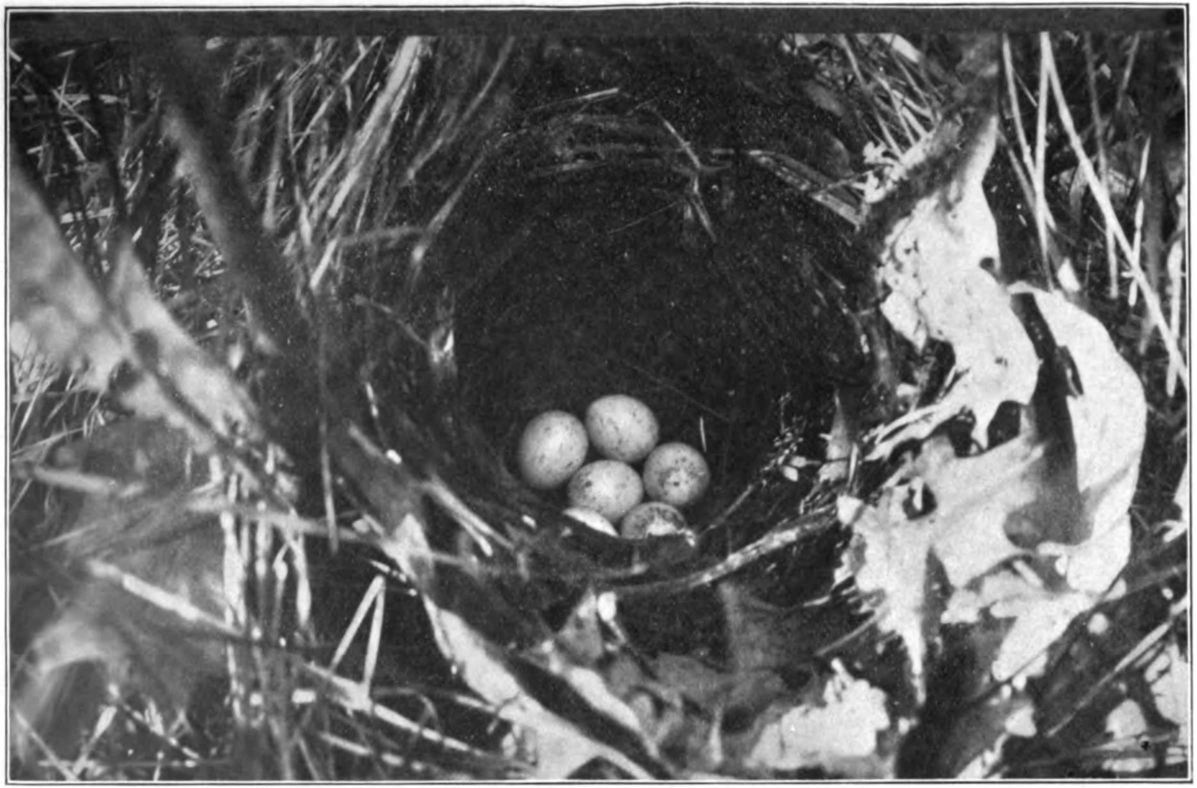
1. Report Bird Mig. in Miss. Valley, by W. W. Cooke, Washington, 1888, p. 240.



NEST AND EGGS OF BLUE-WINGED X NASHVILLE WARBLER.

Photo. by F. E. BURROWS.

in the hope of further developments. Since this time two more specimens have been taken in Walworth County, both in the month of May, and the last, a female, within twenty rods of where the young were found in 1897. Neither of these was apparently breeding when killed.

Helminthophila chrysoptera *(Linn.).* **GOLDEN-WINGED WARBLER.**

This superb warbler is a regular, though rather rare, migrant, and a summer resident from the southern part of the state northward. Dr. Hoy took several nests at Racine, and T. Kumlien procured fledglings in Jefferson County. Grundtvig found it common, in fact, "extremely numerous," in Outagamie County in 1882-3. He found it a common summer resident, but did not find a nest. Recorded by Willard as breeding in Brown County, and by Mr. J. N. Clark from Dunn County. We have found it more common along Lake Michigan than elsewhere, and a rather common breeder at Two Rivers in 1881. It is a regular summer resident in Jefferson County, but as elsewhere is restricted to favorite localities.

Helminthophila rubricapilla *(Wils.).* **NASHVILLE WARBLER.**

A common migrant, becoming exceptionally so in occasional years, especially in the spring. The Nashville warbler nests regularly in different parts of the state. We have nesting records at different times in Walworth County, at Lake Koshkonong, Dunn County, and northward. It is an especially common migrant along Rock River Valley. A favorite nesting site seems to be in tamarack swamps, the nest being placed on *sphagnum*, or reindeer moss.

Helminthophila celata *(Say).* **ORANGE-CROWNED WARBLER.**

Not a very common species in Wisconsin. From the records and observations we are able to bring together it seems considerably more common in the western than in the eastern part of the state. Mr. J. N. Clark finds it common in Dunn County. In Jefferson and Dane counties it cannot be called common, though regular, especially in spring. It arrives rather earlier than others of the same genus, often in the latter part of April. Dr. Hoy was positive that it bred in the state, and we have taken specimens in Manitowoc County in July. These had without question bred there. Thure Kumlien also procured two specimens in Jefferson County on June 16 (1860).

We are confident that it bred in Bayfield County twenty years ago. The majority pass beyond our borders, however.

Helminthophila peregrina *(Wils.).* **TENNESSEE WARBLER.**

Usually an extraordinarily abundant migrant, especially in fall, at some seasons far out-numbering any other species. From all records we can bring together the verdict seems the same—very abundant migrant, but no authentic record of being summer resident, although it is at times common, even in the southern counties, by August 15.

Compsothlypis americana ramalinæ *Ridgw.* **WESTERN PARULA WARBLER.**

A common migrant in all parts of the state, and a summer resident in all suitable localities. Mr. Clark has observed it a number of times during the entire summer in Dunn County. Dr. Hoy found it a regular breeder about Racine, and took several nests. Grundtvig states that many breed in Outagamie County, where he found nests and eggs. Willard gives it as breeding in Brown County. The bird is much more common than generally supposed by the amateur observer. It is easily overlooked during the breeding season, as in this section it usually nests at a great height.

Dendroica tigrina *(Gmel.).* **CAPE MAY WARBLER.**

Migrant in May and from the last of August until the middle of September. In some years it is greatly abundant, and in others quite the reverse. Dr. Hoy found it rather common at Racine in May, and thought that a few bred there in 1852. Mr. Grundtvig found it abundant in Outagamie County in 1882, but did not find half as many the following year. Records from all sections of the state seem to indicate that it is more or less common, especially as a spring migrant. So far as our observation goes it is more common along Lake Michigan than elsewhere. We have no very good records of summer residence, although we saw a number of adult males in June between Green Bay and Sturgeon Bay, in Kewaunee and Door counties. It has also been reported from near Ashland in July.

Dendroica æstiva *(Gmel.).* **YELLOW WARBLER.**

The "yellow-bird" is an abundant summer resident, nesting in every piece of open wood and brushy clearing. It is among the first arrivals of the warblers during the last few days of

April, and is busily engaged at nest building by the 10th of May. Universally common and generally distributed over the state.

Dendroica cærulescens *(Gmel.)*. **BLACK-THROATED BLUE WARBLER.**

A common migrant from May 10 to May 30, and from the first of September until October. All points from which we have any record give this species as common. We are disposed to consider it as really a summer resident in the northern part of the state. There are several records of summer specimens from different sections.

Dendroica coronata *(Linn.)*. **MYRTLE WARBLER.**

Migrant. The most abundant of all the warblers, the first arrival in the spring, and the last to leave us in the autumn. During late September and October it flocks along the roadside like the junco and tree sparrow. Sometimes taken in southern Wisconsin as late as December 1. King (1) says "a few may breed in northern Wisconsin, for I obtained a male at Elk Lake in Chippewa County, July 26, 1876." We have never found it in the state in summer.

Dendroica maculosa *(Gmel.)*. **MAGNOLIA WARBLER.**

The beautiful magnolia is also one of our most abundant warblers during the migrations, which reach their height through May and September. There are no authentic records of this species nesting within the state, but as it is recorded as nesting at Mackinac Island and in the north peninsula of Michigan it would not be surprising if a few summered in the state. All observers report it as common during the migrations, but it is far less plenty than thirty years ago.

Dendroica rara *(Wils.)*. **CERULEAN WARBLER.**

A rather rare species in Wisconsin, though of regular occurrence, especially along Lake Michigan. There are many records for Lake Koshkonong, as this section has been closely observed for a long period. There are also records for Delavan, Milwaukee, Racine, Two Rivers, etc. Mr. Clark has not found it in Dunn County. Dr. Hoy considered it as a breeding species, which is very probably true. There is one record for Lake Koshkonong, June 14 (1872).

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1. Econ. Rel. Wis. Birds, Geol. of Wis. I. 503.

Dendroica pensylvanica *(Linn.).* **CHESTNUT-SIDED WARBLER.**

An abundant migrant and common summer resident. In the migrations this warbler is found everywhere, but during the summer it prefers the open clearings that have grown up thickly with brush of all kinds, particularly hazel and oak scrubs. It frequently becomes the foster parent of the cowbird. This elegant species seems fully as plenty as thirty-five years ago.

Dendroica castanea *(Wils.).* **BAY-BREASTED WARBLER.**

A common migrant, especially in the fall. At this season it sometimes outnumbers all other species. In Jefferson County young have been taken by the middle of August, and we have suspected that some, at least, nest in the extreme northern part of the state, as is surely the case in the northern peninsula of Michigan. An authentic Wisconsin nesting record is, however, yet to be obtained. Some observers report this species as rare, and even absent from certain sections, which it seems must be entirely the fault of the observer. The young in the fall are often confounded with the next. The height of the spring migration in southern Wisconsin ranges from May 10 to May 20, according to the season, and in autumn is from the last days of August to the middle of September. Apparently more common along Lake Michigan than in the interior. Belated individuals have been shot in Jefferson County as late as June 10.

Dendroica striata *(Forst.).* **BLACK-POLL WARBLER.**

Usually the last of the genus to arrive in spring, it is sometimes well toward the end of May when the black-poll becomes abundant. Returning it is common again during the latter half of September and well into October. So far as our records show, it is a common migrant in all parts of the state. There is no authentic nesting record of the species, but it has been noted in the northern counties in June and July, and no doubt a few breed within our borders.

Dendroica blackburniæ *(Gmel.).* **BLACKBURNIAN WARBLER.**

An abundant migrant, arriving with the warbler host early in May. A few nest regularly in the state, even in the southern counties, most often in the tamarack swamps. Eggs have been taken in Jefferson County and young in Manitowoc County (L. K.). Mr. J. N. Clark, of Meridian, writes of this species, and the warblers in general: "Our warblers of every variety, it appears to me, are diminishing in numbers every year. Ten years ago from the 10th to the 25th of May the woods seemed to be alive with them, and I have counted more than a dozen varieties in two hours' observation. Now half a day's search will not reveal half that number. This is also true of many of our insectivorous birds, the Baltimore oriole, phœbe, the vireos and most of the finches being exceptions." This is probably too true of some localities, and probably generally throughout the state to some extent, but there are still many localities where a dozen varieties of warblers can easily be identified, in good numbers, in even less than two hours.

Dendroica dominica albilora *Ridgw.* **SYCAMORE WARBLER.**

A rare straggler to Wisconsin. Dr. Hoy obtained a single specimen at Racine, June 20, 1848. Taken but once by Thure Kumlien, in 1877, at Lake Koshkonong, and once at some other locality in southern Wisconsin at a very early date, 1842-50.

Dendroica virens *(Gmel.).* **BLACK-THROATED GREEN WARBLER.**

Migrant. As is the case with many of the warblers, this one occurs in varying numbers, being sometimes only fairly common, and again greatly abundant, either in spring or fall. Dr. Hoy wrote that a few nest with us, and Mr. Clark suspects that they breed in Dunn County, as he has found them during the summer months. Young just able to fly were taken in Jefferson County in July, 1868, and adults are frequently seen in summer as far south as Rock, Dane, and Jefferson Counties. We have known several pairs to remain in the vicinity of Milton all summer but have never succeeded in finding a nest.

Dendroica vigorsii *(Aud.).* **PINE WARBLER.**

A fairly common summer resident in the pine regions. Migratory in the hardwood districts of southern Wisconsin. Much more common along Lake Michigan than in the interior. A rather early arrival in the spring, generally preceding the majority of the warblers by several days. Although we have never found the nest we have noted this bird at various northern points in June and July. Dr. Hoy gives it as breeding in the northern pine forests, and Mr. Nelson found it nesting in northeastern Illinois.

Dendroica palmarum *(Gmel.)*. **PALM WARBLER.**

One of the most numerous and regular of the warblers during the migrations, from the latter part of April until the middle of May, and again from the last half of September until the middle of October. We can find no evidence that it is ever a summer resident within the state, even in the most northern counties. It is one of the earliest arrivals, and frequents the open country along roadsides, rather than the localities usually selected by warblers.

Dendroica discolor *(Vieill.)*. **PRAIRIE WARBLER.**

A rare straggler to Wisconsin. Dr. Hoy procured but one specimen at Racine, and Thure Kumlien but one at Lake Koshkonong. Unfortunately the dates of capture of both specimens are gone, but both were taken at a very early day, between 1845 and 1860. This species has been recorded from Wisconsin in migration reports by amateurs. One specimen sent us to verify such a record proved to be *D. palmarum*. The Hoy and T. Kumlien specimens are probably the only actual records for the state.

Seiurus aurocapillus *(Linn.)*. **OVEN-BIRD.**

A common bird throughout the summer, the oven-bird nests in suitable localities over the entire state. It arrives with the majority of the warblers the last of April, or very early in May and by June 1 has its oddly roofed nest completed and the eggs laid. During the breeding season the birds are shy and retiring, and the nest is not easily found, the birds retreating as one walks upon them, and by a long circle returning, unseen, to their home. Few sets can be found without one or more cowbirds' eggs. One set in the Kumlien collection contains three eggs of the oven-bird, and five of the cowbird.

Seiurus noveboracensis *(Gmel.)*. **WATER-THRUSH.**

This form of the water-thrush is a common migrant and regular summer resident. It breeds sparingly in the southern counties, and more commonly and regularly farther north. Grundtvig found it a common nesting bird in Outagamie County, and Mr. J. N. Clark writes that it sometimes nests in Dunn County. We are almost exactly on the "dividing line" between *noveboracensis* and *notabilis*, but the former is by far the more abundant. They occur together in southeastern Wisconsin during the migrations. Mr. Wm. Brewster has kindly examined our specimens and finds perfectly typical examples of both races.

Seiurus noveboracensis notabilis *(Ridgw.)*. **GRINNELL'S WATER-THRUSH.**

Regular migrant, even in the extreme southeastern part of the state. Specimens of this race were identified by Mr. Wm. Brewster among the water-thrushes sent for his inspection. It occurs at the same time, and in company with the preceding, and may possibly be the nesting form in the western part of the state. Unfortunately, we have no breeding birds from this district.

Seiurus motacilla *(Vieill.)*. **LOUISIANA WATER-THRUSH.**

The Louisiana water-thrush occasionally occurs in the spring in southern Wisconsin, and doubtless breeds, as this is the extreme northern part of its range. One specimen has been taken at Delavan, Walworth County (May 18, 1900. N. H.), and one in Milwaukee County (April 25, 1897—Copeland and Russel), besides four or five in all about Lake Koshkonong, during the past fifty years.

Oporornis formosa *(Wils.)*. **KENTUCKY WARBLER.**

We appear to be a little too far north for this exquisite species. In southern Wisconsin it is very rarely taken during the spring migrations, when an occasional individual seems to wander out of its usual range. Dr. Hoy took one specimen at Racine (May 10, 1851), and we have but six other records for the state for sixty years, all about Lake Koshkonong, in spring.

Oporornis agilis *(Wils.)*. **CONNECTICUT WARBLER.**

Not so rare a species as generally supposed. By one familiar with its haunts, song and habits, it can be found in some numbers during the latter part of May, the first week of June, and again during September. It is generally spoken of as more common in spring than fall, but we are unable to see any material difference, and if anything find more in autumn, as the young are less shy than the spring adults, and are consequently more often seen. Dr. Hoy considered it not uncommon at Racine, and shot a mated pair, about to begin nest building. In Jefferson County a pair was found, June 16, 1874 (L. K.), putting the finishing touches upon their nest. It was placed on the ground in a dense thicket of hazel, briars, etc. Though the nest was not touched they abandoned it, but bred in the same thicket; the nest, however, could never be found. Has been found in the dense tamarack swamps of Jefferson County in July, on several occasions, when it was, without question, nesting, and we have no doubt that a considerable number nest within the state. It is the very last warbler to pass northward in the spring. Many observers fail to find this species. Mr. Clark has not, as yet, taken it in Dunn County, and it was not found in the State by King, Grundtvig, or Willard.

Oporornis philadelphia *(Wils.)*. **MOURNING WARBLER.**

Migrant. Of very similar habits to the preceding, frequents much the same localities, and, according to our observations, in about the same numbers. It arrives somewhat earlier in spring than *agilis*. In some years it is almost common during the spring migration, for a few days, at Delavan and Lake Koshkonong. Reported by J. N. Clark from Dunn County, but not noted by King or Grundtvig. Dr. Hoy (Racine), and E. W. Nelson (northeastern Illinois), called it rare. By no means rare along Lake Michigan in migrations, especially in spring. Notwithstanding the general breeding range of the two species, as usually given in works of authority, we are of the opinion that this species never breeds in Wisconsin, although the *other does*, quite the opposite of the case, as usually given. We think any breeding record of this species for Wisconsin that may ever have been published, must surely refer to *agilis*. We cannot resist following Mr. Ridgway in including this species in the genus *Oporornis*, where it certainly appears to belong.

Geothlypis trichas brachidactyla *(Swains.)*. **NORTHERN YELLOW-THROAT.**

An abundant summer resident in all suitable localities, and especially numerous during the fall migrations, from the latter part of August until the middle of September. Mr. Wm. Brewster has examined our yellow-throats and writes us under date of July 31, 1902, as follows: "Despite the fact that Palmer calls the bird of the entire upper Mississippi Valley region, east of the 97th meridian, *trichas*, your specimens agree closely with his description of *brachidactyla*, and with my New

England specimens of the same." Prof. Ridgway's views (1) seem to be the same as Mr. Brewster's, and our Wisconsin yellow-throat will, without doubt, stand as ***brachidactyla***.

Icteria virens *(Linn.)*. **YELLOW-BREASTED CHAT.**

In the southern part of the state the chat is a regular summer resident, and in favorable localities breeds rather commonly. It is almost invariably found in some large opening in the wood which has thickly grown up to hazel brush and dogwood, and it is in the latter that the nest is usually placed. The birds are, as a rule, exceptionally shy and retired, and would pass unnoticed by the average observer were it not for the occasional outbursts of their variable mimicry and song. Then by careful stalking one may perhaps be fortunate enough to obtain a glimpse of a streak of yellow and green darting into the air, only to tumble over again into some thicket. When one has located the nest, however, all is different, and one has abundant opportunity to see and hear the birds, as they scold and fret, forgetting their wildness for the time, and coming within a few feet of the intruder. The least disturbance, even to barely touching the nest, is often enough to cause the birds to throw out the eggs, and desert the place, so shy and suspicious are they. The hottest and brightest June or July day is the best to find chats, as it is then that they are at their best in ventriloquist calls and song. Nesting begins early in June, and incubation is finished by the middle of the month. The nests are favorites with the cowbird and nearly always contain one or more of its eggs. The most northern record we have for this species in the state is at Stevens Point.

Wilsonia mitrata *(Gmel.)*. **HOODED WARBLER.**

Not an uncommon migrant along Lake Michigan in southern Wisconsin, and it undoubtedly breeds to the northward of Milwaukee. Much less common in the interior than along the lake shore. We have seen this species repeatedly at Two Rivers in July, but in Jefferson, Dane, and Rock counties only in the spring migration in May. We have also taken specimens at Milwaukee in the latter part of May.

Wilsonia pusilla *(Wils.)*. **WILSON'S WARBLER.**

A common migrant in southern Wisconsin, passing northward late, often as late as the first week of June. Undoubtedly

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1. Birds N. and Mid. Am., Bull. U. S. Nat. Mus., No. 50, pt. II, pp. 655-665.

a few nest in Wisconsin, even as far south as Jefferson County, although there is no actual record. Specimens have been taken near Jefferson, June 16. Young birds are often taken as early as the middle of August in the large tamarack swamps. Principally a frequenter of low lands, and willowy thickets, often in tamarack swamps.

Wilsonia canadensis *(Linn.).* **CANADIAN WARBLER.**

A common migrant during the latter part of May, and again in September. A few nest in central and northern Wisconsin, along the borders of hemlock swamps, but the great majority pass beyond our borders to summer. King mentions taking a fully fledged young bird near Worcester, July 19, 1876 (1), and a pair were seen feeding young, which were flying about, on July 12, 1882, in Door County, to the northward of Sturgeon Bay (L. K.). Nelson reports it as a rare summer resident in northern Illinois. Grundtvig found it the most abundant warbler in Outagamie County in 1882 and 1883, except *Dendroica maculosa*. All other observers report it as common, except King, who calls it rare in central Wisconsin, where it has been noted by others as abundant for the past forty years. More plenty along the borders of swamps abounding in a thick growth of coniferous trees than in the hardwood.

Setophaga ruticilla *(Linn.).* **AMERICAN REDSTART.**

A summer resident. The redstart breeds abundantly in all deep, second-growth woods, though, as usual with many warblers, it prefers the vicinity of a lake, pond, or stream for its summer home. Nesting begins in May, and the family remain together the entire summer, a happy, beautiful, woodland-roving flock of parents and young.

FAMILY MOTACILLIDÆ: WAGTAILS.

Anthus pensilvanicus *(Lath.).* **AMERICAN PIPIT.**

A common migrant, but not always to be depended upon in any locality. On the prairies, dry marshes, and along the lake shore it is sometimes abundant, especially in September and October, and even to November 1. Specimens were taken from a flock near Lake Koshkonong, June 3, 1879, but as might be expected, showed no indications of breeding soon.

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1. Geol. of Wis., I-p. 509.

FAMILY TROGLODYTIDÆ: WRENS, THRASHERS, ETC.

Mimus polyglottos *(Linn.).* **MOCKINGBIRD.**

A rare summer visitant. Many of the records of the mockingbird in Wisconsin are very doubtful, as they are mostly of birds "seen" only, and with a bird of this kind such records are always open to question, as observers not familiar with the species are very likely to make serious mistakes in their anxiety to add a new species to their local list. There is also the regular possibility of its being an escaped cage bird. We have positive records of its nesting on the old Kumlien homestead, in Jefferson County, however, in June, 1879 and 1880, and of one specimen captured in Milwaukee County in August, 1882 (L. K.). Hoy reported specimens seen July 16, 1851, between Racine and Kenosha, and July 26, 1846, near the southern state line. Later (1885), Hoy wrote that mockingbirds nested freely near Racine previous to 1856, that he obtained three nests and knew of several others that he did not molest, but that none had been seen for fifteen or twenty years. In the Bulletin of the Wisconsin Natural History Society for January, 1900, Mr. W. J. Bennetts records one seen by himself June 29, 1894, near Milwaukee, in the same locality where Mr. John W. Dunlop had reported a pair nesting a few years ago, and also states that Mr. Robert O. Wanvig has a nest and eggs, taken in 1897, just west of Milwaukee, from a sheltered grove where he has seen the birds for the past few summers.

Galeoscoptes carolinensis *(Linn.).* **CATBIRD.**

A common summer resident over the greater part of the state. Arrives from the south about the first of May, and very soon commences nest building. A common species about dwellings and towns, unlike the thrasher, adapting itself to civilization and the vast changes which follow in its wake.

Toxostoma rufum *(Linn.).* **BROWN THRASHER.**

Formerly an abundant summer resident. The brown thrasher seems to have greatly diminished in numbers during the past fifteen years, until now it is scarcely common in many localities, and really rare in some, where it once bred in good numbers. That such a magnificent bird, with so fine a voice should grow less in numbers at such a rate is a great pity, and the species should be carefully guarded and protected in every way possible here in its summer home. In some parts of the state it is still fairly common.

Thryothorus ludovicianus *(Lath.).* **CAROLINA WREN.**

A rare straggler to Wisconsin. We have never met the species in the state, and its presence must be considered as merely accidental. One specimen was preserved by Thure Kumlien, which was taken in the summer of 1878 near Janesville. It is recorded by Dr. Hoy, a single bird, from Racine, July 5, 1852. One other specimen at least was taken by Hoy of which we have personal recollection, but the record cannot be found. A single specimen secured at Milwaukee in the summer of 1881, was seen at the shop of a taxidermist in that city.

Troglodytes aëdon *Vieill.* **HOUSE WREN.**

A common migrant in eastern Wisconsin in almost equal numbers with the next. It breeds sparingly anywhere from the southern border northward. It arrives the last week of April and is common until the middle of May, when all but a few pass northward. It nests late in June, in towns and villages as well as in the more retired woods. Mr. Brewster has examined our series of house wrens, and pronounces nearly half to be typical *aëdon*.

Troglodytes aëdon aztecus *Baird.* **WESTERN HOUSE WREN.**

In a series of house wrens from southern and eastern Wisconsin, Mr. Wm. Brewster finds typical examples of both forms, *aëdon* and *aztecus*, the latter slightly predominating in numbers. These specimens were nearly all taken during the spring migrations of various years, and give no clew to the distribution of the two forms during the breeding season. The *aztecus* averaged a little later, but both were sometimes taken on the same day. As the house wrens do not nest until June, as a rule, and this series was mostly made in late April and May, no actual breeding birds at present being available, we are unable to state whether this form nests within the state or not. Mr. Clark finds it a common migrant in Dunn County, and notes that it may occasionally nest, as he has seen it in mid-summer. Possibly these birds, nesting in that portion of the state, are *aztecus*, but actual breeding birds must be had before the summer range of the two forms in the state can be definitely known.

Olbiorchilus hiemalis *(Vieill.)*. **WINTER WREN.**

The little winter wren is a common migrant throughout the state, in early spring and late fall. It unquestionably nests in northern Wisconsin. King (1) found it common in summer in the northern parts of the state, and Dr. Hoy states that it nests on the shores of Lake Superior. Grundtvig thinks that a pair nested in Outagamie County in 1883 (2). Parents were seen feeding young just able to fly, near L'Anse, in the upper peninsula of Michigan, in July, 1879 (L. K.).

Cistothorus stellaris *(Licht.)*. **SHORT-BILLED MARSH WREN.**

A common summer resident in many parts of the state, especially in localities where there are still wild meadows and dry marshes. In other parts, where there are not suitable nesting grounds for the species, it appears to be rare. In Dunn County, Mr. Clark states, it is not nearly as common as formerly, but still nests in most favorite meadows. On Turtle Creek marsh, between Delavan and Whitewater, it is almost abundant, and in late afternoon, if one remains quiet and well hidden, several pairs may be heard singing near by. At the first move, however, they drop into the grass with an angry scold, but soon appear again, often on the opposite side, chattering as only wrens can. Although so plenty on this particular marsh the entire summer, it is seldom seen in any of the surrounding country.

Cistothorus palustris *(Wils.)*. **LONG-BILLED MARSH WREN.**

An abundant summer resident over nearly the entire state, breeding in great numbers about all suitable marshes. The long-bill prefers much wetter localities than the last, and the two species are seldom found in close proximity to one another.

FAMILY CERTHIIDÆ: CREEPERS.

Certhia familiaris americana *(Bonap.)*. **BROWN CREEPER.**

In the southern counties the creeper is a migrant and winter resident only, and most common during April, but in the northern part of the state it is found throughout the summer, and breeds. From the records at our command it is evident

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1. Geol. of Wis., 1873-79, I. p. 491.
2. Trans. Wis. Acad. of Sci. Arts and Letters X. p. 153.

that it summers regularly, though sparingly, from the central part of the state northward. Grundtvig was quite certain that a few bred in Outagamie County, and J. N. Clark observed a pair of creepers feeding a young cowbird, just from the nest, at Meridian in late June, 1897.

FAMILY PARIDÆ: NUTHATCHES AND TITS.

Sitta carolinensis *Lath.* **WHITE-BREASTED NUTHATCH.**

Common. Resident in some numbers the entire year. Nests throughout the state, and becomes more common during fall, winter, and spring, at which time it is a regular city visitor, frequenting the larger trees along the streets.

Sitta canadensis *Linn.* **RED-BREASTED NUTHATCH.**

A regular spring and fall migrant, but not so common as the white-breast. Mr. Clark has found it in winter in Dunn County, and it occurs as late sometimes as November in Walworth, Jefferson and Rock Counties, though usually found in April and September. It was found nesting at Pine Lake, near Hartland, July, 1888. The nest was about ten feet above the ground in a pine stub, and contained young (L. K.). Dr. Hoy states that a few nested near Racine, and as Nelson mentions it as a rare summer resident in northeastern Illinois, it may yet be found nesting in other parts of our state.

Parus bicolor *Linn.* **TUFTED TITMOUSE.**

A straggler from the south. In the museum of the University of Wisconsin there is a single specimen of the tufted tit, shot by Mr. N. C. Gilbert, December 15, 1900, near Madison. The bird was alone, and this is doubtless the only record for the state.

Parus atricapillus *Linn.* **CHICKADEE.**

Abundant. Found in all parts of the state, and resident wherever found. Nests early in May. In winter the chickadee becomes very tame and is often seen about the yards of city residences.

Parus atricapillus septentrionalis *(Harris).* **LONG-TAILED CHICKADEE.**

In late fall and winter typical specimens of this form are taken in Wisconsin, even in the southern part of the state, but more often in the northwestern portion. A number were taken near Hudson in November. We are unable to say whether these are resident in that district, or merely winter visitors.

Parus hudsonicus *Forst.* **HUDSONIAN CHICKADEE.**

A rare winter visitant in southern Wisconsin. Dr. Hoy states that a few visited Racine during the unusually cold January of 1852. A single specimen was taken by Thure Kumlien in Jefferson County at this same time. It is recorded from the northern peninsula of Michigan (Nehrling) and Dr. H. V. Ogden, of Milwaukee, writes us that he saw several, and shot one, in Iron County, but unfortunately did not preserve a skin. He also writes: "I fancy a few could be found every fall in the northern tier of counties." A single individual was noted in Vilas County, at close range, while waiting on a deer runway, in November, 1902, but could not be collected as we were armed only with rifles at the time (N. H.).

FAMILY SYLVIIDÆ: KINGLETS AND GNATCATCHERS.

Regulus satrapa *Licht.* **GOLDEN-CROWNED KINGLET.**

An abundant migrant in early spring and late fall. Dr. Ogden states that it is sometimes found in mid-winter in Milwaukee County, and the same is true of other sections of the state. The golden-crown breeds along the south shore of Lake Superior, in Ontonagon County, Michigan, and possibly to some extent therefore in the pine regions of northern Wisconsin.

Regulus calendula *(Linn.).* **RUBY-CROWNED KINGLET.**

An abundant migrant, somewhat later than the preceding, and more uniformly distributed. It seldom, if ever, remains through the winter.

Polioptila cærulea *(Linn.).* **BLUE-GRAY GNATCATCHER.**

The little gnatcatcher is a fairly common summer resident in the southern part of the state. It arrives early in the spring, in small flocks of half a dozen or more, sometimes by the last week of April. Dr. Ogden has found it breeding in Milwaukee County, and at both Delavan and Milton it nests in reasonable numbers every year. Nest building usually begins by May 20, and by June 1 incubation has commenced. The young are still in the nest up to June 15 or 20, and the families remain together the entire summer. Mr. Clark has never taken this species in Dunn County during a great many years of active collecting and observation. It is doubtful if it is common north of the southern tier of counties, except along Lake Michigan, where it is found in fair numbers as far north as Two Rivers.

FAMILY TURDIDÆ: THRUSHES, BLUEBIRDS, ETC.

Hylocichla mustelina *(Gmel.).* **WOOD THRUSH.**

In south and central Wisconsin the wood thrush is a common summer resident. Arriving from the south the last few days of April, or very early in May, it at once sets about nest building, and incubation is usually completed, or nearly so, by June 1. The firm, solid nest is too often insecurely placed in its position in some bush or frail sapling, and frequently meets with disaster from even a light storm, delaying the birds with their family until later in the season. The majority leave by the first half of September and all have gone before October 1. One of the finest of forest songsters, its beautiful notes are best and most often heard, in all their richness, at break of day in some thick wood bordering on water, as it is in such places that the birds usually make their summer home. In Outagamie County and at De Pere, Grundtvig and Willard noted this species only as a rare straggler.

Hylocichla fuscescens *(Steph.).* **WILSON'S THRUSH.**

A common migrant and a regular summer resident in the northern half of the state. Breeds sparingly farther south, even to the southern counties. Most abundant in southern Wisconsin during the spring migration from May 7 to May 25.

Hylocichla fuscescens salicicola *Ridgw.* **WILLOW THRUSH.**

A single specimen taken at Delavan, May 6, 1899, and identified by Mr. Wm. Brewster, is the sole claim for introducing this race here. We are of the opinion that a careful examination of the migrating *fuscescens* will reveal numbers of this form, especially, it would seem, in the western part of the state.

Hylocichla aliciæ *(Baird.).* **GRAY-CHEEKED THRUSH.**

A common migrant. Most abundant in deep woods with underbrush, or second-growth, keeping mostly, however, near the edges and openings, but ever ready to retreat to the depths of the thicket at the first alarm. Arrives early in May, the majority passing north at once, some stragglers only remaining until the last of the month, and all returning early in September on the way to their winter home.

Hylocichla ustulata swainsoni *(Cab.).* **OLIVE-BACKED THRUSH.**

An abundant migrant, and possible summer resident in suitable localities in the northern part of the State. Arrives in southern Wisconsin early in May, usually a few days later than *aliciæ,* with which it is much associated, not confining itself so closely to the woods, however, being a common bird in towns and even along the roadsides, or wherever there is cover. In the fall it is especially common through the middle of September, in scattered, woodland-roving flocks. This is one of the birds that one most frequently finds dead beneath the ever increasing network of electric wires that annually cause the death of thousands of individuals of the low-flying, night migrating species.

Hylocichla ustulata almæ *Oberh.* **ALMA'S THRUSH.**

Among specimens of thrushes sent Mr. Wm. Brewster for examination (March, 1902), were two of this sub-species. Both were shot at Lake Koshkonong late in May. The difference was detected at once on comparing with others of *swainsoni,* and it must be very uncommon in Wisconsin, although Mr. Brewster later pronounces a specimen from Delavan as "almost if not quite gray enough for *almæ.*"

Hylocichla guttata pallasii *(Cab.).* **HERMIT THRUSH.**

An abundant migrant. This thrush is the first of the genus to arrive in the spring, and is usually found in southern Wisconsin by the middle of April. Migration records for many years give it the following range of dates in Walworth County: April 11 to May 17, and October 2 to 27. Specimens have been secured in Jefferson County in July, and a nest and eggs secured May 29, 1866, were *supposed* to belong to this species, but the identification is open to question. It is found in northern Wisconsin in summer, and no doubt breeds there.

King records the capture of specimens at Waupaca, July 22, 1876 (1).

Merula migratoria *(Linn.).* **AMERICAN ROBIN.**

An abundant summer resident, arriving early in March, or even the last of February, and remaining until the middle of November. Nests may sometimes be seen with the full complement of eggs as early as May 1, before a leaf has appeared on the tree in which they are placed, and young from the nest are not infrequent as early as May 25. The robin is, rarely, found in the dead of winter in southern Wisconsin.

Sialia sialis *(Linn.).* **BLUEBIRD.**

The bluebird was formerly a very abundant summer resident, but the birds which annually visited Wisconsin seem to have suffered as severely from the general southern freeze of a few years ago as those of other parts of their range. During the summers of 1895 and 1896 they were almost wholly absent, but in 1897 they appeared to be slowly gaining in numbers, and have continued steadily to increase, until now they can be classed as common summer residents again. Doubtless the day is not far distant when they will have regained their former numbers. One of the first of the real migrants to appear in spring, the date of the first arrival, of course, depending entirely on the season. They often are here by the first week in March, but it is sometimes well along in the month before the first one puts in an appearance. They remain in the fall until about November 1. Probably no bird in Wisconsin has been so persecuted in its nesting places by the English sparrow as has this species. Formerly a common resident of the towns and villages, nesting anywhere within a few feet of, or even about the buildings, it has been almost entirely driven to the country by this miserable pest.

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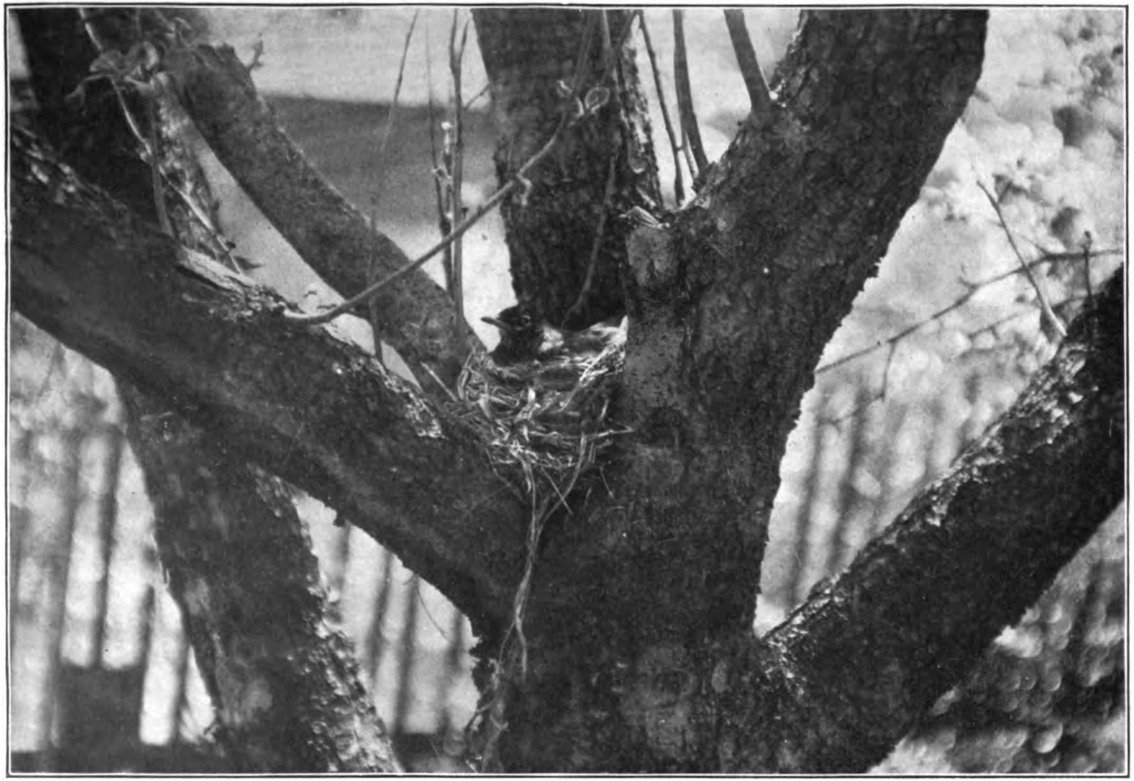
1. Geol. of Wis., I. p. 475.



AMERICAN ROBIN ON NEST.

Photo. by F. E. BURROWS.

HYPOTHETICAL LIST.

Cepphus sp? GUILLEMOT.

We are confident that some species of guillemot occurs on Lake Superior in winter, and possibly also on northern Lake Michigan. There is no positive evidence of a specimen ever having been taken in Wisconsin waters, however. While on Lake Superior we made diligent inquiry among people who had reasons for knowing, and several spoke of a small white "duck," seen in winter. One man in particular was very positive in regard to a duck "big as a teal and speckled in rings all over" that frequented Whitefish Bay in winter. This inelegant description fits the winter plumage of either *C. grylle* or *C. mandtii* very well. Dr. S. Kneeland, Jr., of Boston, makes mention, in his list (1) of the Birds of Keweenaw Point, Lake Superior, of the reports of a nearly white merganser or "sawbill" in that vicinity in winter. He did not think it likely that it could be *Mergus albus*, and as no specimens were procured he was inclined to think "the bird was some white plumaged duck." We think it probable that these birds will prove to be some guillemot, in winter plumage. The occurrence of several other species of *Alcidae* on Lake Superior, as noted in some Michigan lists needs verification.

Rissa tridactyla *(Linn.).* **KITTIWAKE.**

This species has been given a place in former Wisconsin lists on the evidence of Dr. Hoy alone. In an early day Hoy stated that this bird was "met on the lake November, 1853," but later, in December, 1870, he had the opportunity to carefully observe with a strong glass a single individual which remained about Racine harbor for a number of days. An account of this is given in Nelson's Birds of Northeastern Illinois and more fully in a letter later to L. Kumlien. We have no doubt that the doctor's identification of this bird was correct, but it is hardly evidence enough to include the species in the list, as we are not aware of any specimen having ever been taken. We examined a young of the year, mounted, at Ashland, which was said to have been shot among the Apostle Islands, but the party owning it, a Canadian, was recently from the St. Lawrence River country, and this record is considered of no value.

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1. Proc. Bos. Soc. Nat. His., 1856, p. 239.

Gelochelidon nilotica *(Hasselq.).* **GULL-BILLED TERN.**

Included in Dr. Hoy's list of 1852 with the simple statement: "We have but seldom met the marsh tern in this vicinity." Nelson, in Birds of Northeastern Illinois, says: "An exceedingly rare visitant during summer." Various Michigan lists give it as "often abundant on Lake Michigan," "common, Saginaw River in January," etc., etc., all of which is too absurd for serious consideration. We know of no actual record for Wisconsin, and have never seen the bird in the north.

Sterna maxima *Bodd.* **ROYAL TERN.**

The only reference to this species as a bird of Wisconsin that we know of is that of Dr. Hoy, who in his list of 1852, says "rarely visits us," and is later quoted by Nelson (1) as authority for the statement that "a specimen was taken at Milwaukee many years ago and preserved in a museum there." We very much doubt if this species should be retained as a Wisconsin bird. Dr. Hoy does not mention *caspia*, which makes us suspicious that the specimen referred to was of that species. Furthermore we carefully went through the Natural History Society's collection at Milwaukee a number of times between 1873 and 1875, and although there used to be an old specimen of *caspia* there, we never saw or heard of a specimen of *maxima* (L. K.).

Procellariidæ? PETREL.

There is a belief among lake captains and others that some species of petrel is found at times on Lake Michigan. We are very much inclined to doubt it, however, and there are no records to substantiate their statements.

Anhinga anhinga *(Linn.).* **ANHINGA.**

In a paper on some of the rarer birds of Dodge County, Wisconsin, by W. E. Snyder (2), the author includes this species as having "been shot by a Mr. Chatfield some twenty years ago," and "described" to Mr. Snyder by him. As we consider this no evidence whatever that this strictly southern species ever visits us, we cannot accord it a place in our list.

Phalacrocorax carbo *(Linn.).* **CORMORANT.**

We have investigated several reports of *P. carbo* having been taken in the state, but have never found a record worthy

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1. Birds of N. E. Illinois, 1877, p. 147.
2. Bull. Wis. Nat. His. Soc., April, 1892

of a moment's consideration, and do not think the species ever even straggles to our border.

Branta leucopsis *(Bechst.).* **BARNACLE GOOSE.**

In the Wisconsin Agricultural Report, 1852, Dr. Hoy reports having seen a barnacle goose in Racine harbor in December, 1850. The bird referred to by Dr. Hoy, we personally and positively know, was ***Chen cærulescens***, a bird at that time, of course, unknown to the doctor.

Tringa ferruginea *Brünn.* **CURLEW SANDPIPER.**

Given in Barry's list of 1854 as "at one time quite common" in the vicinity of Racine, but "has entirely disappeared." It is almost unnecessary to state that this must be an error. He no doubt refers to some other wader, possibly to ***Micropalama himantopus***, as this species is not included in his list, although given by Hoy two years previous from the same locality.

Catharista urubu *(Vieill.).* **BLACK VULTURE.**

We do not consider the records of this species for Wisconsin sufficiently authentic to warrant us in giving it a place at the present time. Will no doubt straggle to the state some time, *via* the Mississippi River.

Ictinia mississippiensis *(Wils.).* **MISSISSIPPI KITE.**

From the fact that no specimen of this bird has ever, to our knowledge, been actually taken within the borders of the state we must place it among those which will some day without doubt be added to our list. The A. O. U. Check-List and other works of authority give the species as casual in Wisconsin, doubtless on the authority of Dr. Hoy's note of having "seen" a specimen in 1846. Thure Kumlien was sure of having seen it, and we are equally sure ourselves. It is remarkable that all the birds "seen," though ranging in time from July, 1846 (Hoy) to August, 1870 (L. K.) should have been on Rock River, within a few miles of the same place. Dr. Hoy's surmise that it is occasionally met on the Mississippi River, is possibly correct. Mr. Skavlem, of Janesville, is quite positive that he shot a specimen of this kite when a boy, many years ago in Rock County, but prefers that he be not made responsible for the record, as there is possibly a doubt, although he admits that he is himself positive in regard to the identification. A specimen mounted for the Oshkosh Normal

School was secured from a local taxidermist, who said it was shot at Lake Koshkonong. Later developments, however, failed to verify this.

Falco (Hierofalco) sp. GYRFALCON.

Some species of gyrfalcon has been credited to the fauna of Wisconsin in an early day, a thing by no means impossible or unlikely; but there is no actual record obtainable at present. There was formerly a specimen preserved at Oshkosh, which was said to have been killed near Lake Winnebago.

Falco mexicanus *Schleg.* **PRAIRIE FALCON.**

An intimate friend of Thure Kumlien's, and a very close observer of birds, often spoke of a hawk which he said was very close to the duck hawk, and was quite annoying in chicken shooting on the larger prairies at an early day. He secured a specimen in the fall, sometime in the early sixties, that came into the possession of Thure Kumlien in a badly decomposed state, but was preserved. This bird was never satisfactorily identified otherwise than as a young prairie falcon, which it probably was. The specimen, however, is not at our command at present, and we cannot give the species a place in the list, though quite sure of the identity.

Empidonax virescens *(Vieill.).* **GREEN-CRESTED FLYCATCHER.**

We have never taken this species in Wisconsin, and all the observers with whom we have had correspondence have also failed to find it. Hoy and some later writers include it in their lists, but evidently without positive proof. The fact that Hoy appears to have been somewhat mixed on his flycatchers, as indeed many at that time were, and that all recent collections fail to produce a specimen, although furnishing both varieties of *traillii*, whereas Hoy included but one, of course, leads us to believe that a mistake has occurred, and we await future developments.

Centronyx bairdii *(Aud.).* **BAIRD'S SPARROW.**

This species has been credited to Wisconsin, and though it is by no means impossible that it might occur, the record in question is open to suspicion, as the balance of the skins in the box, some twenty in number, were taken near Vermillion, South Dakota.

Junco aikeni *Ridgw.* **WHITE-WINGED JUNCO.**

In the Auk for January, 1885, page 32, Prof. W. W. Cooke records a specimen of this bird from Jefferson, Wisconsin, January 14, 1883. In answer to our inquiries for more information regarding the capture, Mr. Cooke states that he now has considerable doubt of his record, and does not consider the species entitled to a place in a Wisconsin list on his evidence.

Vireo belli *Aud.* **BELL'S VIREO.**

This bird has been taken within a few miles of the Wisconsin line in Illinois, and near Chicago, by Nelson. Although it has been credited to the fauna of Wisconsin the proof is still lacking. A specimen sent to us for the purpose of verifying the record proved to be *V. noveboracensis*. In the early forties Thure Kumlien procured specimens of a vireo which he called *belli*, of which he had no description, simply to distinguish it from *gilvus*. This led to some confusion with Lawrence, Baird, and others who had not seen the specimens. The bird referred to was later described by Cassin as *V. philadelphicus*.

Dendroica kirtlandi *Baird.* **KIRTLAND'S WARBLER.**

We regret that there is no actual record for the state of this rare warbler. All lists, and the best of authorities, include Wisconsin in the geographical distribution of the species, but on no better evidence, so far as we know, than that Dr. Hoy once "saw it." We do not doubt this in the least, but it hardly makes a record to be so widely quoted. Dr. J. M. Wheaton (1) in speaking of the species soon after its discovery says: "These two are the only individuals discovered, unless it be one shot by Prof. Hoy, of Racine, Wisconsin," but later (2) simply states that "Dr. Hoy thinks that he has seen it at Racine." In Hoy's list of 1852 he simply says: "I met one single individual of this recently discovered species, at Racine, May 20, 1853." Thure Kumlien, during fifty years' residence in Jefferson County, near Lake Koshkonong, and in one of the best warbler territories in America, would not admit that he was ever sure of having seen it. The same was our experience until May 24, 1893, when we stood watching an unusual number of warblers, flitting from bush to bush across a willowy marsh near Lake Koshkonong, and scattering as they reached the higher trees. We were wondering how some of our migration experts would

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1. Ohio Ag. Report, 1860, Second Series, p. 374.
2. Geol. Surv. of Ohio, Vol. IV, 1882, p. 264.

have estimated the number of each species, when directly in front of us, and not ten feet away, we saw what we still believe was a fine adult male of Kirtland's warbler. We stepped back a pace or two and fired. Then followed an exciting race back and forth, through, under, and over a barb-wire fence, among weeds, brush, ditches and springs until we were nearly exhausted. The bird could almost fly, and when, by a master stroke, we captured him, and in handling such a rarity as one would naturally do, he escaped, we were unable to dislodge him from the immense brush pile where he sought safety. Thus, though we are positive in our own mind, of having seen, shot, and even handled a specimen of Kirtland's warbler, we have no record. The bird has been taken in Michigan, Illinois, and Minnesota, and it is probably only a question of time before some fortunate Wisconsin ornithologist can add it to our list with an authentic record.

Thryomanes bewickii *(Aud.).* **BEWICK'S WREN.**

This species has been credited to Wisconsin, but we think on insufficient evidence. We are unable to find an authentic record of an actual capture. Grundtvig was in error when he thought it "must surely be found at Shiocton" (Outagamie County).

Ixoreus nævius *(Gmel.).* **VARIED THRUSH.**

We are under the impression that Hoy recorded a single specimen of this species as captured by himself at Racine, but are at present unable to find the reference, and have no personal knowledge of the capture.

Sialia arctica *Swains.* **MOUNTAIN BLUEBIRD.**

Dr. Hoy examined a specimen of this species in a local collection, which was said to have been shot in Wisconsin, across the river from Dubuque, Iowa. In a personal letter to L. K., he says: "There can be no doubt of this record," and adds that a "second specimen was taken near La Crosse late in the autumn of 1856." He did not see the last mentioned specimen, however. Until one of these specimens, at least, is brought to light again, we do not feel like including the species on this slight evidence. It is included in Dr. Kneeland's list (1856) of the Birds of Keweenaw Point, Lake Superior.

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BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 3, New Series. **NOVEMBER, 1905.** **No. 4.**

PROCEEDINGS.

September 25, 1902.

President Teller in the Chair.

In the absence of the general secretary Mr. Adolph Biersach was chosen temporary secretary.

Applications for membership were received from the following persons: Emil S. Weisse, Elcho, Wis.; Erskine E. Bailey, Little Rapids, Wis.; Frederick F. Jahn, Ironwood, Mich.; Glenn W. Camp, Mukwonago, Wis.; Henry Severing, University of Wisconsin, Madison, Wis.; Clarence Olen, Winneconne, Wis.; Nic. H. Terens, Mishicot, Wis.; Ephraim D. Oswald, Mishicot, Wis.; Lafayette Ellerson, Big Bend, Wis.; E. W. Beebe, Milwaukee; H. E. Haferhorn, Milwaukee; and Carl Biersach, Milwaukee.

The name of Clarence B. Moore of Philadelphia, Pa., was proposed by the Archæological section for honorary membership.

These applications were referred to the directors for action.

Mr. Louis Lotz gave an informal account of a trip taken by him the past summer to Montezuma Co., Colorado, and to the mesa or table-land region of the cliff dwellers. At the conclusion of his remarks the speaker was invited to prepare a fuller account of his trip, to be read at a subsequent meeting of the society.

October 30, 1902.

President Teller in the Chair. Twenty-five members present.

Mr. A. Biersach gave a report of the meeting of the Biological sections held Oct. 9th.

Mr. C. E. Brown gave a report of the meeting of the archæological section held Oct. 23rd.

The secretary then gave an extended account of the asters of eastern Wisconsin illustrated by a series of specimens collected during the present autumn.

Applications for membership were received from Messrs. Henry L. Ward, Charles Koubeck, and Dr. J. C. Lange, all of Milwaukee.

November 28, 1902.

President Teller in the Chair. Sixty-five persons present.

Mr. C. E. Brown presented a report of the last meeting of the archæological section at which papers were presented by Miss Lapham, Dr. Peet and Mr. Gerend.

Applications for membership were received from the following: Howland Russell, Dr. John Madden, Wm. Segall, Dr. Carl Bruck, James K. Mazak, Chas. Quarles, J. W. S. Tomkiewicz and Fremont Utter.

The President referred to the unfortunate omission of the name of one of the oldest and most esteemed members of the archæological section from the published list of members.

Mr. Louis Lotz then read an interesting and extended account of a trip undertaken by him in August and September of the present year to the Mesa Verde in southwestern Colorado and of his investigations and explorations among the famous canyons and ancient cliff dwellings of that region.

At the conclusion of his address a vote of thanks was given unanimously to the speaker upon the motion of Mr. H. A. Crosby.

Mr. Charles H. Doerflinger presented some important and interesting notes of recent archæological discoveries in southern France. He mentioned the discovery in the caves and grottos of this region of sculptures and engravings in ivory, horn and bone, representing both animals and human beings; and particularly the quite recent discovery upon the walls of the grottos themselves of both incised and painted representations of animals, including the bison, reindeer and horse, believed to have been contemporaneous in execution with the sculptures and engravings upon bone and ivory. The age of all is placed at from 10,000 to 12,000 years before the Christian era. The speaker, also called attention to the fortunate joining of forces in France by archæologists and geologists and to the desirability of such harmony of action in other countries and in Wisconsin.

December 18, 1902.

President Teller in the Chair.

Mr. Adolph Biersach presented a report of the biological section meeting held Dec. 11. At this meeting Mr. Wm. Vogel exhibited cases of butterflies from India; Dr. S. Graenicher, fresh water shells from Douglas County; and Mr. Wm. H. Elkey gave an account of the method of collecting shells from the Mississippi river for the manufacture of buttons.

By request, the University of Rennes, France, was placed on the exchange list of the society.

Dr. Ernst Hautke and Dr. J. F. Snyder were proposed for active membership and Dr. François Daleau of Bourg sur Gironde, France, was proposed as an honorary member.

Miss Harriet B. Merrill then favored the meeting with an entertaining account of a trip taken by her the preceding summer and fall, in the course of which she visited the cities of Pernambuco, Bahia, Rio de Janeiro, sâo Paulo and Santos in Brazil, Buenos Aires in Argentina and Ascension in Paraguay, including a brief account of each of these places and of a steamboat trip up the Para and Paraguay rivers.

January 29, 1903.

President Teller in the Chair. Eighty persons present.

Mr. Adolph Biersach reported an informal meeting of the general sections held on Dec. 8th.

Mr. C. E. Brown presented a report of two meetings of the archæological section, held on Dec. 29, and Jan. 16, at each of which a number of papers were presented on subjects of interest.

Requests were received from several libraries to exchange with the society. These were granted.

Applications for membership were received from the following: Oscar Altpeter, Alfred Fischer, Robert Wild, and Wm. Orth. Mr. H. L. Ward, the director of the Public Museum then read an interesting and comprehensive paper, illustrated with stereopticon slides on "Meteors and Meteorities."

February 26, 1903.

President Teller in the Chair. Twenty-five persons present.

Mr. Adolph Biersach reported a meeting of the biological sections held Feb. 12, at which Messrs. Finger, Brown, Lotz, and Teller took part in the proceedings.

Mr. Charles E. Brown reported a meeting of the archæological section held Feb. 20, at which papers were read by Prof. Wm. H. Beach and Miss Julia Lapham; and papers by J. T. Reede of Calumet, Mich., and W. R. Moorehead of Andover, Mass., were read by members present at the meeting.

Applications for membership were received from the following: H. W. Frieden of Mineral Point, Wis., and H. P. Severin of Winneconne, Wis.

A paper by Ernst Bruncken on the flora of the lake shore region of Milwaukee County was read by the secretary.

March 26, 1903.

President Teller in the Chair. Fifty persons present.

Mr. Frank Collins Baker, curator of the Chicago Academy of Sciences then delivered a lecture, illustrated with stereopticon slides upon the subject "Snails; How and Where they Live."

At the conclusion of the address, the president expressed the thanks of the society to the lecturer.

April 30, 1903.

Annual meeting. President Teller in the Chair.

Dr. F. C. Mock read a paper on the subject "Comparative Anatomy and Evolution", showing how the obscurities presented by individual ontogeny are elucidated by the study of comparative anatomy, and how the doctrine of evolution is supported by both.

The President extended the thanks of the society to the lecturer for his able and interesting address.

The Treasurer presented his annual report, summarized as follows:

Balance on hand April 24, 1902	$103 11
Cash received during the year ending April 30, 1903	347 90
	$451 01
Total disbursements for the year	$396 35
Cash on hand April 30, 1903	54 66
	$451 01

The Secretary presented a verbal report. Both reports were accepted.

The Secretary then reported on the meeting of the biological sections held April 9th.

The next order of business being the election of officers, Dr. G. W. Peckham nominated all the present incumbents for the same offices and moved that Dr. S. Graenicher be directed to cast the unanimous vote of the society for their reelection. The motion was carried and the following officers declared reelected. President, E. E. Teller; Vice-president, Dr. C. D. Stanhope; Treasurer, L. R. Whitney; Director, C. E. Brown; General Secretary, C. E. Monroe.

The Secretary reported that the directors had voted to recommend the amendment of by-law I so as to make the annual dues of non-resident members $3.00, or the same as those of resident members. The motion was lost.

Dr. S. Graenicher then moved that the by-law be amended so as to make the annual dues of non-resident members two dollars in place of one. This motion was carried.

The Secretary then read a letter from Mr. Henry A. Crosby, president of the newly organized Wisconsin Archæological Society, announcing the formation of the latter society and requesting for it the privilege to assume the publication of the "Wisconsin Archeologist."

On motion of Dr. Peckham, it was voted that this be granted.

June 4, 1903.

The regular May meeting, postponed. President Teller in the Chair.

Dr. John Madden gave a very interesting account of his observations on wild red foxes on the Door County Peninsula, describing their habits and relations to men and domestic animals.

September 24, 1903.

Dr. G. W. Peckham in the Chair. Seventeen persons present.

The resignation of Mr. L. R. Whitney as treasurer was presented.

The name of Miss F. Schnellenmeyer was presented for membership.

Mr. Wm. Finger exhibited a large number of flowering plants collected in the course of a trip to the Yellowstone Park. Many specimens of different orders from high altitudes exhibited the same tendency toward strong development of the underground portions with stunting of the upper parts.

The Secretary presented a few specimens of asters collected at Kaukauna and High Cliff, Wis., and offered for examination the advance sheets of Kumlein and Hollister's "List of Wisconsin Birds" soon to be issued by the society.

Miss Harriet B. Merrill spoke of the work upon which she had been engaged of studying and identifying the Crustacea collected by her during her South American trip.

Dr. Graenicher spoke of his investigations among the solitary bees of the genus *Halictus*, and gave an interesting account of their habits, especially of a semi-social species, many specimens of which occupy the same underground tunnel, each female digging off from that her saparate apartment and taking turns at keeping watch of the nest-opening.

Mr. C. E. Brown exhibited a specimen of the edible fungus, *Polyporus frondosus*; and also half a dozen species of dragon flies new to Milwaukee County, there having been collected about 70 species in the county.

Dr. Peckham spoke of the habits of the solitary wasps is stinging or mutilating their prey and discussed the question as to whether there was any other motive or reason for this other than that of making transportation easy by preventing resistance or removing limbs which might cause friction. He inclined to the opinion that this was the only object sought.

Mr. Brown gave notice of the recent death of Dr. Ernest Hautke, a member of the society and moved that a committee be appointed to prepare suitable resolutions. Mr. Brown and Mr. Altschwager were appointed such committee.

October 29, 1903.

President Teller in the Chair. Mr. C. L. Mann Secretary *pro tem.*

The following resolution was adopted:

Resolved, That in the death of Mr. Ernest Hautke, a member of the Wisconsin Natural History Society, this society has lost a valuable member who liberally gave his time and thought to promote its success.

Resolved, That a copy of this resolution be forwarded, with assurance of our deep and respectful sympathy to the afflicted widow and family of the deceased.

Mr. Adolph Biersach presented a report of the meeting of the biological sections held October 15th.

The resignation of Mr. L. R. Whitney was accepted and Mr. Wm. Finger elected to fill the vacancy.

Mr. Adolph Biersach then read a paper on the cultivation of the banana and plantain. This was followed by a general discussion and reference was made to the question of the cultivation on this continent of the Manila hemp plant, a species of *Musa*.

December 3, 1903.

President Teller in the Chair.

Mr. I. N. Mitchell and Dr. James Zawady were proposed for membership, and elected.

Mr. Henry L. Ward gave an informal account of his late visit to the Pacific coast. Mr. C. L. Mann spoke of the trees and wild animals of the woods of northern Wisconsin and Michigan.

January 28, 1904.

President Teller in the Chair.

Mr. Walter S. Hummel was presented for membership.

Dr. S. Graenicher read an able and interesting paper on parasitism among our wild bees. Miss Denton, Dr. Case and Mr. Ward took part in the discussion which followed.

March 3, 1904.

The postponed February meeting. President Teller in the Chair.

Dr. E. C. Case favored the meeting with an interesting explanation of the newly propounded "Aggregation theory of World Building." Many members took part in the discussion which followed.

March 31, 1905.

President Teller in the Chair.

Mr. H. L. Skavelem of Janesville, favored the society with an interesting paper on "The food of the Canvas-back Duck on Lake Koshkonong, giving the results of his own investigations, and showing the food of the duck to be the seeds of species of *Potamogeton.*

April 28, 1904.

The annual meeting. President Teller in the Chair.

The report of the Treasurer was read and approved and on his motion an auditing committee was appointed consisting of Messrs. Graenicher, Russell and Case.

A nominating committee consisting of Messrs. Peckham, Graenicher and Ward was appointed and reported as follows: For President, E. E. Teller; Vice-president, H. L. Ward; Secretary, C. E. Monroe; Treasurer, Wm. Finger; Director, C. E. Brown. As Mr. Brown expected to be absent from the city Dr. S. Graenicher was put in his place, and the ticket elected by unanimous vote resulting as follows: President, E. E. Teller; Vice-president, Henry L. Ward; Secretary, C. E. Monroe; Treasurer, Wm. Finger; to Board of Directors, Dr. S. Graenicher.

The general Secretary gave an address on the subject: "Some Factors of Evolution." Messrs. Peckham, Russell and Ward joined in the discussion that followed.

The name of H. L. Skavlem was proposed for membership and he was elected.

May 26, 1904.

President Teller in the Chair.

Mr. Adolph Biersach, Secretary of sections reported a meeting of the biological sections held May 12, when the following officers were elected for the ensuing year. Directors: Botanical Section, Howland Russell; Geological Section, C. E. Monroe; Palæontological Section, E. E. Teller; Ornithological Section, H. L. Ward; Entomological Section, Dr. S. Graenicher.

Dr. George W. Peckham then delivered an informal address on the subject of "Animal Behavior", in which he discussed the nature of animal intelligence and the distinction between intelligence and instinct. Messrs. Graenicher, Case and Ward took part in the discussion which followed.

June 30, 1904.

President Teller in the Chair.

Mr. H. T. Jackson of Milton, was elected a member of the society.

Mr. Ernest Bruncken gave an extended description of the "Forests of the Southern Appalachians", including the forest conditions of the region and the method of reforesting employed on the Biltmore property.

September 29, 1904.

President Teller in the Chair.

Mr. H. L. Ward exhibited skins of two subspecies of the Gray Squirrel, *Sciurus carolinensis leucotis* of the eastern province and *S. c. hypuphæus* of the western. Both occur together in Racine County, showing that this locality is the boundary line between the ranges of the two forms.

Mr. Ward also exhibited a series of casts of skulls beginning with that of *Pithecanthropus erectus*, from the Tertiary of Java, and including those of the Neanderthal man and the man of Spy, and ending with dolichocephalic and brachycephalic human skulls of the present time, showing the character of the first in the series to be intermediate between the simian and human types.

Mr. C. E. Monroe exhibited specimens of *Aster divaricatus* L. and *A. leptocaulis* Burgess, showing the difference between the former or eastern species and the latter which is common in eastern Wisconsin. He also showed a series showing the relationship between *A. azureus* Lindh, and *A. l ris* L. as proved by resemblances between both flower heads and leaves in variant forms of the two species.

October 27, 1904.

President Teller in the Chair.

Mr. C. E. Brown read a detailed and interesting account of the display of exhibits of the Philippine Islands at the Louisana Purchase Exposition at St. Louis.

December 1, 1904.

President Teller in the Chair. Howland Russell Secretary *pro tem.*

Dr. S. Graenicher read an interesting paper on "The Colors of Flowers and their relations to Insect Visitors."

December 29, 1904.

President Teller in the Chair.

Mr. W. J. Greenleaf gave an informal account of the methods of welding metals.

January 26, 1905.

President Teller in the Chair.

Mr. H. L. Skavlem of Janesville gave an account of his investigations on the food and food habits of the Canvas-back duck during the summer of 1904, illustrating his account with specimens of food plants obtained at Lake Koshkonong. A general discussion followed, participated in by Messrs. Russell, Finger, and Bartlett.

The President called the attention of the members to the very small attendance at the meetings of the society. A discussion as to the best methods of stimulating interest followed, participated in by Messrs. Bartlett, Ward, Skavlem, Russell, Finger and others. On motion of Dr. Bartlett it was voted that a committee be appointed to assist the existing permanent committee on programs in planning and providing lectures of a popular character. Messrs. Bartlett, Russell and Case were appointed on such committee.

February 23, 1905.

President Teller in the Chair.

Mr. H. L. Ward delivered an interesting and instructive lecture on the relations of the public to the Public Museum.

March 29, 1905.

President Teller in the Chair.

Mr. Chas. T. Brues, curator of invertebrate zoology at the Public Museum gave an interesting address, illustrated by stereopticon slides on "The Mexican Cotton Boll-weevil and the Cotton Bollworm."

Mr. H. L. Ward proposed the name of C. T. Brues for membership.

April 27, 1905.

Annual meeting. President Teller in the chair.

Mr. Finger presented his report as Treasurer for the past year.

Cash on hand April 28, 1904	$4 41
Cash received during the year ending April 27, 1905	240 16
	$244 57
Total disbursements for the year	$27 80
Cash on hand, April 27, 1905	216 77
	$244 57

The following officers were elected for the ensuing year: President, E. E. Teller; Vice-president, H. L. Ward; General Secretary, C. E. Monroe; Treasurer, Wm. Finger; to Board of Directors, Dr. S. Graenicher.

The name of C. G. Carpenter was proposed for membership.

Dr. E. C. Case delivered an address on "Oecological Features of Evolution".

The General Secretary called the attention of the society to the death of Horace Beach, a member of the society.

May 25, 1905.

President Teller in the Chair.

Mr. H. L. Ward moved that a committee be appointed to arrange for the publication of a bulletin. The motion was carried and Messrs. Ward, Peckham, and Monroe were appointed such committee.

Mr. Howland Russell gave a talk on the "Milwaukee Arboretum".

Mr. Henry L. Ward spoke on "Eolithic Implements", exhibiting an illustrative series recently obtained for the Public Museum from England.

SOME OBSERVATIONS ON THE LIFE HISTORY AND HABITS OF PARASITIC BEES.

BY S. GRAENICHER.

We are rather poorly acquainted with the habits of those bees, that lay their eggs in the nests of other bees, instead of constructing nests of their own. They figure under the name of inquilines or guest-bees, while the rightful occupants of the nests are called host-bees. Some writers invariably make use of the term "parasitic bees" when referring to guest-bees in a general way, although in at least one instance the larva of the guest-bee has been observed as a commensal in the nest of the host-bee, and not as a parasite. Our knowledge is especially deficient in regard to the fate of the egg or larva of the host-bee after one or more eggs of the guest-bee have been placed in the same cell together with the egg of the host-bee. In this respect I have been able to gather the following information from the literature. Packard, (1), in referring to nests of *Andrena* and *Halictus*, collected at Salem, Mass., by J. H. Emerton, states that both sexes of *Nomada imbricata* Sm., and several females of *Nomada pulchella* Sm., were found in the nests of *Andrena vicina* Sm., as also some specimens of *Nomada imbricata* in the cells of *Halictus parallelus* Say. According to Packard "there seems to be enough for *both* genera to feed upon, as the young of both host and parasite were found living harmoniously together, and the hosts and their parasites are disclosed at the same time."

Concerning the relations between the bumble-bee and its guest-bee *Psithyrus* I copy from Sharp, (2), the following. "The *Bombus* and *Psithyrus* live together on the best terms, and it appears probable that the latter do the former no harm beyond appropriating a portion of their food supplies. Schmiedeknecht says they are commensals, not parasites." Farther on Sharp remarks: "The cells in which the young of the *Psithyrus* are hatched are very much larger than those of the *Bombus* and it may therefore be presumed are formed by the *Psithyrus* itself." Fabre, (3), has come across from 2 to 12 eggs of the guest-bee *Stelis nasuta* in the nest of the much larger mason-bee *Chalicodoma muraria*. The several larvae of *Stelis nasuta* live frater-

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1. A. S. Packard. Guide to the Study of Insects, 6th Ed. (1878), p. 142.

nally side by side, devour the food supply of the host, grow rapidly and spin their cocoons before the host-larva has reached one-fourth of its size. According to Fabre's opinion the latter dies of starvation, but he has not been able to verify this by observation. In some cases he has found the dry remains of the mason-bee among the cocoons of the guest-bee, but he has just as frequently discovered nothing whatever of the mason-bee larva. There is another guest-bee *Dioxys cincta* that lays its eggs in the nest of *Chalicodoma*. Fabre, (4), has repeatedly encountered either the larva or the imago of Dioxys in the nest of the mason-bee, but never the slightest trace of the latter in the same cell. Verhoeff, (5), seems to be the only one who so far has witnessed, and described the attack of a parasitic guest-bee on the larva of a host-bee. The parasite in this case is *Stelis minuta* Nyl., inhabiting the nest of *Osmia leucomelaena* Kirby. The host-bee constructs her nest in dry blackberry stems by excavating the pith, and forming a tunnel in which a row of cells is placed, one above the other. Each cell is partly filled with the mixture of honey and pollen usually called "bee-bread," and is separated from the adjoining one by a partition made of pieces of green leaves chewed by the bee, so as to form a soft pliable mass. Verhoeff emphasizes the following points. 1. *Stelis minuta* deposits its egg earlier than the host-bee, and in the lower region of the bee-bread. 2. The larva of the parasite hatches a little earlier than that of the host-bee, whose egg is situated on top of the bee-bread. 3. Both larvæ, which at the beginning are of about the same size partake of the bee-bread, the host-larva on top, the parasite below. 4. The latter gradually increases in size, and consequently advances towards the host-larva on top. 5. Finally the parasite, which in the meanwhile has become twice as large as the host-larva comes in contact with the latter, kills it, and eats it. Verhoeff informs us that there was a mutual exchange of hostilities between the two larvæ, each trying to grab the other with its mandibles, but that finally the parasite succeeded in burying its mandibles in the head of the host-larva. The latter was eaten up within 1 or 2 days. This account given by Verhoeff has been considered somewhat in detail for the purpose of comparing his results with those obtained by me from observations made on *Stelis sexmacu-*

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2. D. Sharp. The Cambridge Natural History, Vol. 6, p. 59.
3. J. H. Fabre. Souvenirs Entomologiques, Vol. 3, p. 114.

lata Ashm. in the nest of *Alcidamea producta* Cress, a bee of the family *Osmiinæ*.

Sharp, (6), sums up the status of our knowledge of the doings of the larvæ of parasitic bees in the nests of host-bees. He says "in such cases the resulting larvæ eat and grow more quickly than the progeny of the host-bee, and so cause it to die of starvation. It has been observed that some of these parasitic larvæ, after eating all the store of food, then devour the larvæ they have robbed. In other cases it is possible that the first care of the parasitic larva, after hatching, is to eat the rival egg."

A number of observations made during the last 3 years on a few species of parasitic bees of our region (representing the genera *Stelis*, *Coelioxys*, and *Triepeolus*) bring out several new points in this connection.

STELIS SEXMACULATA ASHM. A PARASITE OF ALCIDAMEA PRODUCTA CRESS.

The parasitic bee *Stelis sexmaculata* was described by Ashmead from specimens bred from the nests of *Alcidamea producta* collected by Davidson in the vicinity of Los Angeles, Cal. From Davidson's, (7), description of the nest we learn that the Californian *Alcidamea producta* builds its nest in the stems of the elder tree by excavating the broken twigs, and constructing of pith and clay the partitions between the cells, as also those near the opening of the nest (the "outer defence" as Davidson calls them). In our region this bee makes the partitions out of pieces of chewed leaves, and never uses clay for this purpose. In this variation of habits *Alcidamea producta* remains true to the habits in vogue within the family to which it belongs, since some species of *Osmia* utilize clay, while others resort to vegetable matter. On July 20, 1903, I witnessed at Cedar Lake, Washington County, Wis., a female *Alcidamea producta* obtaining her leaf material from a wild strawberry, *Fragaria virginiana*, situated about 3 m. from her nest. The leaves of this plant are rather hairy on the under side, and when thoroughly chewed they form a felt-like, pliable mass. *Alcidamea* flies in the surroundings of Milwaukee from the beginning of June to about the middle of August, and selects the dry stems of elder, blackberry, sumach, and other plants for nesting purposes.

The bee-bread in the nest of this bee is comparatively dry,

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4. J. H. Fabre. Loc. cit., p. 117.
5. C. Verhoeff. Zoologischer Anzeiger, Vol. 15, p. 41.

and forms a conical mass with the slightly curved egg of 2 to 3 mm. length on top. The newly hatched larva has its head directed downward towards the base of the bee-bread.

During the month of July, 1903, seven nests of this species, harboring the parasite *Stelis sexmaculata* either in the egg or larval stage were procured, partly from the surroundings of Milwaukee, partly from Cedar Lake (Washington Co.). Of the 24 cells in these nests 15 were infested by *Stelis*, a percentage of 62.

In the following I offer a brief account of the observations made on one of these cells, as taken from my notes:

July 9, 1903.	Nest collected at Milwaukee contains 4 cells. Third cell (from below) with a parasite. On top of the bree-bread an *Alcidamea* larva, about 3 days old. On the side of the bee-bread, about half way up a *Stelis* larva feeding on bee-bread. It is smaller then the host-larva, and its head is directed upward, and towards the posterior end of the latter's body.
July 13.	The parasitic larva has grown considerably but is not as large as the host-larva. At 1 P. M. the parasite moves upwards a short distance, comes in contact with the host-larva, and secures a hold on the latter's side behind the middle of the body. The victim at first makes an effort to free itself, but offers no serious resistance. The parasite remains in the same position the whole afternoon, sucking the liquid contents of the host's body. The latter gradually perishes, and shrivels.
July 14.	The parasite has released its hold on the dead host-larva, and is feeding on bee-bread. It has lately increased very much in size. From now on the parasite does not pay any more attention to the remains of the host.

In the cell just considered a single parasite was present, but in a nest collected at Milwaukee, July 15, 1903, a cell was come across with 3 parasitic larvae, all of them on the same side of the bee-bread as the head of the host-larva. One of them was situated above the middle, not far below the host-larva, the second was lower down and directed laterally and the third was below the second and quite close to it. In the evening the third parasite, which throughout the day (July 15), had been partaking of bee-

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6. D. Sharp. Loc. cit., p. 20.

bread and growing in length reached the second and killed it. Four days later this same parasite killed the uppermost one and fed on its contents. Two days after this (July 21), the surviving parasite killed the host-larva. Both were about equal in size.

From the study of these 2 infested cells, as also of the remaining material at my disposal, we are presented with several noteworthy facts concerning the instincts of this particular parasitic larva. The most conspicuous feature is the pronounced aggressive tendency of the larva of *Stelis sexmaculata* as compared with the rather tolerant demeanor of the host-larva. It is superiority in size and strength that wins the victory in the case of this parasite. At the time of the attack the parasite was usually decidedly smaller than the host. In one instance (nest found at Cedar Lake, Washington Co., July 24), the host was at least four times as large as the parasite, and still the latter seized the host behind the head, and held on as successfully as any of the larger ones. In this case, after the parasite had been allowed to suck for a few minutes a slender pin was passed between the head of the parasite and the body of the victim, and the former forced to release its hold. This was done for the purpose of witnessing the effects of the bite, as also the subsequent behaviour of host and parasite. The host-larva withdrew the front part of its body by unsteady, swaying motions (similar to a human being in a dazed condition) but it gradually resumed its former position on the bee-bread. A small drop of yellowish fluid oozing from the skin behind the head indicated the point of attack. Before long it again came into dangerous proximity to the parasite, whereupon the latter by a quick motion regained its hold in nearly the same spot as before. The host-larva made some lively attempts to get rid of the aggressor, but undertook nothing in the way of a counter attack.

Whenever two larvæ of the parasitic bee *Stelis sexmaculata* are brought together in the same cell they begin hostilities as soon as they come in contact with each other. The one that secures the first hold survives, and the victim is subjected to the same treatment as the larva of the host-bee.

The behaviour of the larvæ of host-bees when brought in contact with each other in the same cell differs greatly from that of the larvae of parasitic bees. I have experimented along this line with the larvæ of several species of host-bees, and have not yet seen one of the larvæ injured by its neighbor, although un-

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7. A. Davidson. Entomological News, Vol. 7, p. 316 (Sept., 1896).

der certain circumstances the larvæ of one of the species were observed attacking each other. Undoubtedly the degree of tolerance varies in the different species. The most tolerant of the species under consideration proved to be *Ceratina dupla* Say, a bee suffering to a great extent from the presence of two Ichneumonid parasites in its nests. The tolerance displayed by its larva towards the larva of one of these Ichneumonids (*Habrocryptus graenicheri* Viereck) has been pointed out in a previous paper. (8.)

On July 9th, 1903, several cells of *Ceratina dupla* were provided each with two eggs, without increasing the food supply. In two of the cells the larvae lived long enough to develop into pupae on August 4th, and from one of these cells two female bees made their appearance, from the other a male and a female. These specimens were naturally much smaller than the average bee of this species since the larvae had been brought up on half rations. Not one of these larvae, while living close together, was ever seen to make an attack on the other occupant of the cell. This was not even done at the critical period when the food supply had become exhausted before the larvae had reached their normal development.

Four larvae from a nest of the leaf-cutter bee, *Megachile infragilis* Cress. procured at Cedar Lake, Washington Co., on August 1st, 1905 were experimented with in the same manner as the *Ceratina* larvae. They never attacked each other. But when the two larvae in the comparatively narrow cell had grown to such an extent that there was not room enough for both of them, one was crowded out by the other, and died. This happened in both cells under observation.

From a nest of *Osmia atriventris* Cress., found in the same locality, and on the same date, three larvæ of different size were taken out of their cells, and placed on a portion of bee-bread. They were brought face to face to each other, and so close together as to be in each other's way, especially after increasing in size. These larvæ never showed any signs of hostility towards each other, but arranged matters by taking up new positions on the bee-bread so as to interfere less with each other when feeding.

The results obtained with the larvæ of *Alcidamea producta* differed in some respects from those discussed above. Being well supplied with material I was enabled to make repeated experiments with these larvæ last summer (1904), as also this year.

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8. S. Graenicher. Entomological News, Vol. 16, p. 43 (Febr., 1905).

During the early part of their life the larvæ of this species live quietly side by side, but they gradually become less tolerant, and from the age of 5 or 6 days on they often grab each other with their mandibles when in close contact. On several occasions I have seen one of them secure a firm hold on another's body, and toss it around, without, however, puncturing the skin, or making any attempts at feeding on the one attacked. Under these circumstances the larvæ become very restless, do not feed normally, and die before reaching their full development.

Through the fact that the attack of the *Alcidamea*-larva does not produce any visible injury, while the bite of the parasitic larva of *Stelis sexmaculata* punctures the skin of the host-larva I have been led to examine the mandibles of the two larvæ. In the parasite the mandible is simple and sharp-pointed, (Fig. 3), in *Alcidamea* the apex of the mandible is broad and cleft (Fig. 2), and this difference in structure explains the difference in the result of the bite. The sudden attack of the parasite has evidently also much to do with the outcome.

An examination of the mandibles of several other species of host-bees gave the following information. ***Osmia atriventris***, Cress., *Megachile infragilis* Cress. and *Ceratina dupla* Say. have larvae with cleft (bidentate) mandibles, while in *Calliopsis andreniformis* Sm., and *Prosopis pygmæa* Cress. the mandibles are simple.

There is a difference in the degree of tolerance as displayed by the larva of the host-bee *Ceratina* on one side and that of the host-bee *Alcidamea* on the other, but even in the latter case the actions of the larva have hardly anything in common with those of the parasitic larva of *Stelis sexmaculata*. The *Alcidamea*-larva is not hostile during the first days of its existence, and later on it attacks only when stimulated by close contact with a neighboring larva. Furthermore its bite is ineffective, and is never accompanied by any sucking movements. In *Stelis sexmaculata* the biting instinct is in evidence from the beginning, and the larva is able to give up its original position on the bee-bread, and advance towards its victim. As a result of the bite the skin of the latter is pierced, a firm hold is secured, and sucking is begun at once.

The egg of *Stelis sexmaculata* (Fig. 1b), is mostly deposited near the base of the bee-bread, but occasionally higher up, and in one instance it was lying on top alongside of the host's egg (Fig. 1a). It is only half as long, and a trifle more than half as broad as that of the host, and accordingly the newly hatched parasite is about half as long, as the young host. When fully developed the larva of ***Alcidamea*** spins its cocoon, hibernates as a "resting larva," pupates in spring, and emerges some time in June. The same applies to its parasite ***Stelis sexmaculata,*** although its time of flight begins somewhat later than that of ***Alcidamea.***

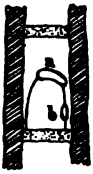
The habits of ***Alcidamea producta*** and its parasite ***Stelis sexmaculata*** agree in a general way with those of ***Osmia leucomelaena*** and its parasite ***Stelis minuta*** as described by Verhoeff, but in several important points they differ very decidedly. Verhoeff informs us that the larva of the parasite at first equals in size the host-larva, but that at the time of the attack it has become twice as large as the latter. He also states that after a combat has taken place between the two the host-larva succumbs to the attack of the larger, and more powerful parasite, and is eaten up by the latter in the course of a day or two.

The whole information derived from the study of ***Alcidamea producta*** and ***Stelis sexmaculata*** points to the aggressive instincts, and the sharp mandibles of the parasitic larva as the factors determining the fate of the host-larva. The size and strength of the parasitic larva have little, if any influence on the outcome. From the start the parasite is only one-half as long as the host, and at the time of the attack it may be of only one-fourth the length of the *Alcidamea*-larva, and still perform its deadly work with perfect success. The host-larva is doomed from the beginning. The encounter between the two is an extremely one-sided affair, and can not be called a combat, since the acts of hostility are evident on the side of the parasite only. The latter instinctively attacks any larva within its reach, and destroys a larva of its own kind in the same manner as it does the host-larva. If there be two or more parasites within the same cell all but one will have to perish. The victor invariably takes up a large portion of the liquid contents of the dead larva, but was never seen to eat up the latter entirely. Its essential food is the mixed supply of honey and pollen stored away by the host-bee. On this it feeds after leaving the egg, and to this it returns soon after the death of its victim.

BEES OF THE GENUS CŒLIOXYS IN THE NESTS OF LEAF-CUTTER BEES.

1. *Cœlioxys lucrosa Cress*. A parasite of Megachile addenda Cress.*

The leaf-cutter bee ***Megachile addenda*** selects the de-



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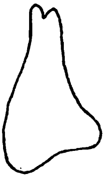

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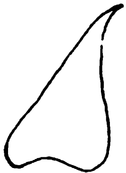

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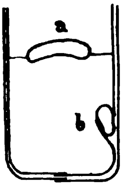

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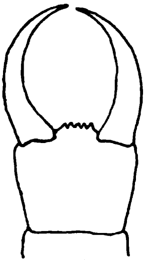

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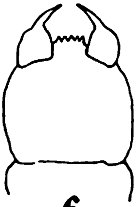

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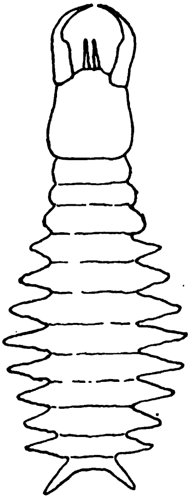

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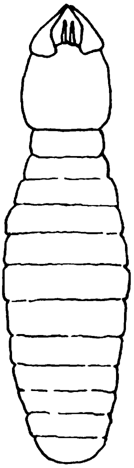

8.

serted burrows of coleopterous larvæ in partly decayed branches or logs laying on the ground. After clearing out such a burrow the bee proceeds to construct its cells with pieces cut out of green leaves in the manner characteristic of the leaf-cutter bees. Such a cell is about half filled with bee-bread, and an egg 5mm. in length deposited on the surface. One or more cells are constructed, and the opening of the nest filled with minute particles of chewed wood.

A nest of this species from the neighborhood of Milwaukee, was opened on September 3, 1903, and found to contain two cells, one of which as later events showed was infested by *Cœlioxys*. A visit of *Cœlioxys lucrosa* to this nest was noted the day before. The following gives an account of the happenings inside of the infested cell.

September 3, 1902.	Host-egg present, no parasite visible.
September 5.	The host-larva hatches in the afternoon.
September 8.	Host-larva alive, has grown considerably. Around noon the head of a second larva (*Cœlioxys*) with extremely long, slender, and curved mandibles (Fig. 5), makes its appearance from out of the depth of the rather soft food-supply, biting aimlessly in different directions, and within a short time piercing the body of the host-larva. Later on the parasite withdraws, and feeds on bee-bread, opening and closing its long mandibles which seem to be rather unfit for this pupose. The attacks on the host-larva are renewed from time to time, and during these the parasite is seen sucking the body juices of the victim. The latter finally dies from the repeated attacks without ever having offered any noteworthy resistance. It does not seem possible that the larva of the leaf-cutter bee with its comparatively small mandibles could ever successfully resist an adversary armed with such formidable weapons of attack. The head of the parasite has a hard brown covering

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*This species seems to be *C. lucrosa*, Cress, but it may prove to be an undescribed species.

September 8.	which furnishes support to the enormous mandibles, and at the same time protects the head from an attack.
September 9.	The body of the dead host-larva has not been entirely eaten by the parasite.
September 12.	The *Cœlioxys*-larva has moulted. In its new form it has a white head with small mandibles (Fig. 6), and resembles somewhat the larva of the leaf-cutter bee. The large sickle-shaped mandibles, and the brown flattened head-shield have been entirely cast aside.
September 16.	The parasitic larva has gradually lost its former slender form, and looks much like a host-larva. The dry remains of the leaf-cutter larva are still in the nest.
September 18.	Parasite dead.

2. *Cœlioxys rufitarsis, Sm., a parasite of Megachile melanophæa, Sm., and Megachile latimanus, Say.*

Megachile melanophæa constructs its cells in the ground, mostly not more than 6 or 9 cm. below the surface. A nest of this species was examined at Cedar Lake, Washington Co., July 13, 1903. The only cell in it was inhabited by a *Cœlioxys*-larva and not a trace of the leaf-cutter larva could be found. The parasitic larva in this case closely resembled the newly hatched larva of *Cœlioxys lucrosa* described above, and it passed through its first moult on July 16 with the same results as in the other case. On August 12, it pupated, and the bee *Cœlioxys rufitarsis* emerged September 4.

A nest of *Megachile latimanus*, another species nesting in the ground was visited by the parasitic bee *Cœlioxys rufitarsis* 3 times on the afternoon of July 13, 1903, also at Cedar Lake. The following day it was opened. It contained an unfinished cell with an egg of the parasite, 2½ mm. long but no egg of the host-bee. This egg of *Cœlioxys rufitarsis* hatched July 17, giving a duration of the egg stage of 4 days. The larva died before moulting on July 23.

Through this nest I became acquainted with the mode of oviposition of *Cœlioxys* which is quite unique in its way. With the sharp and rigid end of its abdomen the bee pierces the inner layer of leaves forming the cell, and into the slit thus formed it forces the egg. (Fig. 4b.) The latter is not of nearly equal width throughout as the egg of the average bee, but broadens out considerably at its anterior (cephalic) pole. On account of its peculiar shape the egg can not pass through the slit in its entirety. With its lower two-thirds it is resting between the inner and the adjoining layer of leaves while the upper portion protrudes slightly into the bee-bread. This mode of oviposition explains the purposes served by the characteristic structure of the conical sharp-pointed abdomen in *Cœlioxys*.

In the nests discussed above either a single egg or a single larva of the parasite *Cœlioxys* had been come across in the same cell, but at Cedar Lake on September 26, 1903 a nest of ***Megachile latimanus*** was found with 4 eggs of the parasite in one cell. They were not far apart from each other, but all of them were situated nearer to the bottom of the cell than to the surface of the bee-bread.

The host-bee *Megachile latimanus* extends its nest-building activity into the first half of October and its parasite ***Cœlioxys rufitarsis*** is still in evidence at this time of the year. On October 3, 1903, a female of this parasitic bee was captured at Milwaukee flying around an embankment in search of the nests of its host, and a dissection of this specimen brought 4 eggs to view, one of which was ready to leave the body, while the others were in different stages of development. This bee, our largest species of *Cœlioxys* is, as fe have seen a parasite of two species of ***Megachile*** that build their nests in the ground. It produces at least two broods a year, the bees of the first appearing around the beginning of July from hybernated specimens (probably passing the winter as larvæ), those of the second brood coming out about 2 months later. Besides the specimen reared from the nest of *Megachile melanophæa* I obtained an additional one from a nest of ***M. latimanus*** opened at Milwaukee on July 20, 1904. The larva in this case spun its cocoon on July 23, pupated on August 1, and emerged as a bee on August 20.

While the larva of *Stelis* ***sexmaculata*** the parasite of ***Alcidamea producta*** is equipped with simple and sharp, but not large mandibles, the larva of *Cœlioxys* leaves the egg with mandibles of enormous dimensions. These are very effective as weapons of attack but rather inconvenient for their owner when the latter is engaged in taking up food. Several days after the larva has appeared on the surface of the bee-bread, a period sufficiently long for the parasite to perform its deadly work, mandibles and head-shield are thrown off by moulting, and replaced by a round head with short mandibles. Before the moulting process we have the head of a rapacious larva, afterwards one more adapted to the life of the average bee-larva. It is hardly necessary to state that the presence of such a larva in the cell of a leaf-cutter bee means certain death to the rightful owner.

TRIEPEOLUS HELIANTHI ROB., A PARASITE OF MELISSODES TRINODIS ROB.

Melissodes trinodis, a ground inhabiting bee digs down perpendicularly to a depth of about 8 cm., then turns off obliquely for a short distance, and continues in a perpendicular direction. The cells are somewhat thimble-shaped, their walls are formed of hardened clay with a very smooth and polished inner surface. They are filled about one-half with bee-bread.

The visit of the parasite ***Triepeolus helianthi*** to a nest of ***Melissodes trinodis*** on August 17, 1903 led me to open the nest on the day following. Two cells were exposed, one unfinished, the other closed, and showing the white, opaque egg of the host, 3mm. in length on the surface of the bee-bread. Nothing else was observed on this date. My further notes are as follows:

August 20, 8 P. M.	The *Melissodes*-egg seems to be near the point of hatching.
August 21, 6 A. M.	The recently hatched host-larva is dead, and has evidently been killed by a parasite. Close to it on the bee-bread is the dead body of a parasitic larva with long curved mandibles (***Triepeolus helianthi***). Crawling lively around the smooth wall of the cell, above the bee-bread another larva of ***Triepeolus*** is observed, making biting movements. After a while this larva crawls down to the bee-bread, and bites the body of the dead parasite a few times in succession. Later on the sharp mandibles of a third parasite appear from below the surface of the bee-bread, also making biting movements.
8 A. M.	Only one parasite alive, crawling around the wall. On the bee-bread the dead bodies of the two other parasites, as also of the host-larva. Any interference with the cell causes the parasite to open and close its mandibles several times. This larva has a number of flat lateral appendages (Fig. 7), organs of locomotion that

August 21, 6 A. M.	enable the insect to crawl around. The mandibles are, in size and appearance very similar to those of *Cœlioxys* (Fig. 5).
August 23.	The parasite is now spending most of its time on the bee-bread, feeding. It is not quite as agile as previously, but still making biting movements when disturbed. These are always performed in the same characteristic manner. At first the mandibles are pushed deep down into the bee-bread, closed and held quietly in this position for a few seconds. After this they are retracted so as to leave only their tips in contact with the bee-bread, and then opened and closed several times in rapid succession.
August 24.	The larva has moulted. The mandibles are small and the lateral appendages have nearly disappeared. In its present form the larva does not leave the bee-bread, and the biting movements are not as pronounced as formerly.
August 25.	Parasite dead.

A second nest of ***Melissodes trinodis*** dug out on August 25, 1903 furnished a cell with a larva of the parasite that had already moulted some time before. The lateral appendages were not in evidence in this larva, and it therefore seems probable that after the first moult has taken place, and the larva has begun a sedetary life on the bee-bread these appendages gradually disappear. (Fig. 8.) In the cell under consideration no remains of a host-larva could be discovered, but the dead bodies of two more parasites were found on the bee-bread. In this cell, as in the one from the first nest three parasitic larvae have been waging war on each other for the sole possession of the cell and its contents.

The parasitic larva of ***Triepeolus helianthi*** with its powerful mandibles and its head-shield resembles very closely the larvae of our two species of *Cœlioxys* referred to in this paper. But in ***Triepeolus*** we become acquainted with a new feature in the make-up of a bee-larva, viz., organs of locomotion that enable the owner to leave the bee-bread and crawl around on the interior of the cell. One of these parasites on the smooth wall may be in a more favorable position to attack than one below on the bee-bread.

CONCLUSION.

A consideration of the facts now in our possession from different sources leads to the following conclusions, regarding the larval habits of those bees that deposit their eggs in the nests of other bees.

In some cases we are probably not dealing with parasitism at all but with commensalism, where the larvæ of the host-bee and the intruder live quietly together, and reach their final development. Such seems to be the case with the species of *Nomada* in the nests of *Andrena* and *Halictus* as reported by Packard. The larvæ of *Stelis nasuta*, several of which according to Fabre live together in the same cell of *Cholicodoma* without attacking each other also seem to be commensals although we do not know whether they finally attack the host-larva or are indirectly the cause of its death by starvation. *Stelis minuta* observed by Verhoeff in the nest of *Osmia leucomelœna* and *Stelis sexmaculata* observed in our surroundings in the nest of *Alcidamea producta* are both decidedly parasitic, *Stelis sexmaculata* attacking with equally destructive results the host-larva as well as a larva of its own kind.

Parasitism among bees produces some very important changes in structure (hypermetamorphosis) and habits of the larvæ as demonstrated by the species of *Cœlioxys* and *Triepeolus* treated in this paper. The extraordinary development of the mandibles of these larvæ would seem to be quite out of proportion to their needs if the destruction of the harmless host-larva were the only thing to be accomplished. But when we remember the fact that these parasites are frequently present to the number of two or more in one cell, and have to fight with each other for the undisputed ownership of the cell, then the question suggests itself whether these weapons of attack, as also the peculiar organs of locomotion in the larva of *Triepeolus* have not been developed as a result of the struggle of these larvæ among themselves.

To my knowledge several writers have attempted to explain the origin of parasitism among bees. A more extended acquaintance with the larval life of guest-bees, as well as of host-bees from different regions of the globe might furnish a more solid foundation for a theory of this kind. The various degrees of tolerance exhibited by the larvæ of different species of host-bees might have to be considered in this respect, and for this reason I have laid especial stress on the pronounced tolerance of the larva of the host-bee *Ceratina dupla*, the lesser degree of tolerance of the larva of the host-bee ***Alcidamea producta***, and the aggressive tendency of the larva of the parasitic bee ***Stelis sexmaculata***.

Fig. 1. Diagrammatic longitudinal section through a cell in the nest of ***Alcidamea producta*** Cress.
a. Egg of ***Alcidamea***. b. Egg of parasite ***Stelis***.
Fig. 2. Mandible larva of ***Alcidamea producta*** Cress.
Fig. 3. Mandible of larva of parasite ***Stelis sexmaculata*** Ashm.
Fig. 4. Diagrammatic longitudinal section through lower half of a cell of ***Megachile latimanus*** Say.
a. Egg of ***Megachile***. b. Egg of parasite ***Cœlioxys***.
Fig. 5. Head of larva of parasite ***Cœlioxys rufitarsis*** Sm., before 1st moult.
Fig. 7. Larva of parasite ***Triepeolus helianthi*** Rob., before
Fig. 7. Larva of parasite ***Triepeolus helianthi, Rob.***, before 1st moult.
Fig. 8. The same several days after 1st moult.

CANVAS-BACK DUCK FOOD.

H. L. SKAVLEM.**

**Abstract of a paper read at the April meeting of the Wisconsin Natural History Society (1904) and published in full in The Northwestern Sportsman, 1905, pp. 161-164, 236-240.

Ornithologists have been accustomed for many years to copy Wilson's description of food habits of the canvas-back duck with reference to its fondness for "wild-celery," *Vallisneria spiralis*, and the good effect of the same on the flavor of the flesh. The writer shot canvas-back duck on Lake Koshkonong for a quarter of a century, believing that the *Vallisneria* was the bait which attracted the birds to the lake, but in locating the celery beds found that the duck usually chose other spots where no celery was to be found, although examination of their stomach always revealed "buds" having a strong taste of celery presumably derived from the *Vallisneria*. Very often they would settle on the great submerged meadows of pondweed (*Naidaceae*) locally called moss or sedge.

During the season of 1895 the writer discovered in examining masses of this floating pondweed that the so-called "celery-buds" were none other than the terminal buds of this plant. This explained their indifference to the *Vallisneria* and fondness for localities where the pond-weed (*Potamogeton pectinatus*) was abundant since the latter forms the real food of the ducks.

An examination of the literature on the subject reveals a surprising number of incorrect assumptions and erroneous statements on the part of various authors, regarding the food of the canvas-back. Wilson states that the ducks feed on a plant "said to be a species of *Vallisneria*" growing on fresh water shoals, and that they dive to tear out and obtain the roots which have the appearance of small celery. It appears that Wilson had in mind the common "eel-grass" (*Zostera marina*) and not *Vallisneria* at all. Nuttall (Amer. Ornith., III p. 29) corrects Wilson's error and states that the birds feed on the tender parts of the root of the "sea-wrack." Audubon in his great work overlooks Nuttall's correction and repeats Wilson's remarks on *Vallisneria*. Chapman (Hand-book of Birds of Eastern N. Amer., 6th Edit. (1903), p. 111) describes the favorable effect of wild celery on the flavor of the canvas-back. If for "wild celery" we substitute *Naidaceae* (which includes *Zostera* (eel-grass), *Ruppia* (ditch-grass) and the species of *Potamogeton* (pond-weed), *Zizania* (wild-rice), *Hydrocardiaceae* (to which *Vallisneria* belongs) we have the proper list of food plants. At Lake Koshkonong it was found that "celery-buds" (*Potamogeton pectinatus*) formed from 60% to 80% of the ducks' food.

OECOLOGICAL FEATURES OF EVOLUTION.

BY E. C. CASE.

The attention that has been called to the principle of adaptive radiation by the recent papers of Prof. Osborn and his followers in the American Naturalist has led to the suggestion that some good might be derived from viewing the subject from a slightly different standpoint. Osborn has concerned himself with a demonstration of the fact that in successive periods the various phyla have developed in a diffuse way producing a large number of forms peculiarly adapted to the local conditions and that this process has been repeated with close similarity in each period. Other writers have concerned themselves with the way in which the adaptations have been produced; all writers have looked at the subject from the standpoint of the animal. It seems worth while to look at the subject from the standpoint of the environment; to analyze the environment in order to detect its possibilities in influencing the change in the animal form.

For the purposes of the discussion it is recognized that adaptation is as much a fact as heredity and its processes as much of a mystery. With the ***processes*** the dicussion has nothing to do nor even whether the environment induces the adaptations; it is assumed that the environment changes and that the ***adaptation follows the environment.***

Most of the points gone over have been discussed before and are even the classics of the literature of evolution but so far as I know no one has attempted to place the environment in the foreground of the discussion. This our increasing knowledge of the principles of physiography and of the climate and surface of geological areas will enable us to do with increasing value.

New names do not explain old problems and the few introduced here are only used for the purposes of clarity.

For simplicity in approaching the subject let us take a concrete example. An animal (the principles seem equally applicable to plants but the author's limitations compel him to turn to animals for illustrations) of generalized structure and potential variability enters by migration a new region; the overwhelming chances are that it will encounter one of two conditions, either the ***sum of its contacts*** with its new environment (using the term environment in its widest sense, food, competion, enemies, climate, surface, breeding places, etc.,) will be hostile to the new form, ***environmental hostility*** (lack of adaptation in the animal), or the sum of its contacts with the environmental will be favorable, ***environmental hospitality*** (adaptation in the animal). The third possibility, that the animal will find the sum of its contacts so exactly balanced between the two that their effects will be neutralized is so remote that its occurence can only be considered as an interesting possibility. There will of course be all grades of hospitality and of hostility from the superlative to the least possible that will result in the triumph or extinction of the animal.

Should the animal encounter environmental hostility its habits or structure or both must become altered (adapted) or the form will perish, and its variants will be more liable to persist than the parent. Should it encounter environmental hospitality it would survive and variations would be more liable to extinction than to preservation (see below).

The environment of any life form is not necessarily the sum of all the factors that we can appreciate. There may be many things of which we have no consciousness which bear importantly on the form; or things which we can appreciate only by an effort, or things which we appreciate but to which we attach no value. To take one of the least complex instances, we appreciate the color of a flower only through an artifically cultivated aesthetic sense but that color is often the determinant factor in the environment of the flower or the insect which visits it. The possible number of differing sums of contacts is so enormous that it is possible and probable that no two groups of animals have exactly the same.

The fact that forms in a condition of seeming environmental hospitality do develop new forms is explainable on the supposition that there are unperceived factors in the environment or that of those perceived we have given an undue importance to one or more and the sum of contacts may have a reversed sign from our determined answer. The very fact of environmental hospitality must in time produce an opposite condition.

The condition of environmental hostility may result from two sources.

I. From contact with other animals. This may be again subdivided into two parts. ***Active hostility*** and ***passive hostility.*** Active hostility of the environment would mean the attacks upon the life of the animal by predatory forms; perhaps also the attacks of parasites and even bacterial invasions. So far as the animal is preyed upon by other animals it forms an element of hospitality in the environment of the predatory form and conversely if it finds forms in the new region which it preys upon they become elements of hospitality in its environment. So complex are the relations that the introduction of an element of hostility to one form may result in an increase of hospitality to another as when a predatory form abandons the refuse of its meal to the carrion feeders. Darwins classic example of the relation between the number of cats and the clover crop of a neighborhood is a case in point.

Passive hostility of the environment from animals is almost if not quite the same as the hostility of inanimate things. The competition for food, breeding places, etc., among different forms and among individuals of the same species; it involves the struggle for existence among life forms.

II. From contacts other than animal. Under this head must be grouped a large series of contacts which can only be suggested within the limits of this article. *Climate*, this may be favorable or unfavorable to the new form in its tendency to drought, humidity, great range of temperature or stability of temperature. *Surface*, the rough or broken surface, hills, plains, plateaus or swamps; each would afford peculiar possibilities for or against food, protection, breeding places, etc. *Rocks and soils*, affording facilities of burrowing, etc. *Hydrographic features* as rivers, lakes, each carrying its aid or opposition to the new comer. The list might be extended almost indefinitely but would have to be varied for each form and almost for each individual.

Should the animal encounter conditions of hostility in its new environment its only chance for survival would be the development of new structures or habits that would enable it to use more or fewer than the original contacts or be able to use or resist the originally hostile contacts in such a way as to alter their effect from hostility to hospitality.

At this point another element must be considered, that of *time*. This element is worthy of rather more consideration than it has already received. The assumption of unlimited time is one that paleontology has inherited from its foster-mother geology and the assumption has also tinged the writings on recent zoology. The form in an hostile environment has but two goals before it, adaptation or extinction. That the latter has been commonly attained we have ample evidence. The change in the environment which renders it hostile to the animal may be sudden or very slow. In the former case the animal has small chance for survival. Such a case would be the introduction by migration of a predatory form as the introduction of the hunter with his gun, into regions previously unvisited. The burning of forests and prairies; volcanic eruptions, etc., would have only a very local effect, upon species of limited distribution, upon varieties or races and even on individuals. But the clearing off of the established forms may open the way for the introduction of migrant forms; this is especially well illustrated in the occupaton of burnt over lands by the new forms of plant life. In every case swift extinction will follow if the animal does not produce changed form or habit fitted to the changed environment. If the necessary change is one involving habit the possibilities of the animal responding in time to avoid extinction are greatly increased but this depends in a large measure on the potential variability of the animal; the seals return year after year to the same breeding place and to almost certain extinction. The English Sparrow on the other hand has developed familiar habits and breeds on the structures that man has erected in place of the destroyed forest. The chimney swallow has accepted the chimney in place of the hollow tree and the work of man has become an element of hospitality in their environment. The birds mentioned have developed habits in time to profit by the changed environment, it is doubtful if the seal will do so.

Adaptations in structure or function would require a much longer time and could not possibly win out against any sudden change but might do so through the long time involved in changes due to geological development of changed land surfaces and climates. This last statement must not be interpreted to mean that a suddenly developed new form as one of DeVries primroses or any sport that becomes established would necessarily encounter environmental hostility at the beginning; for the new structure, function or habit might, in the rare instances when such a form is established, present a peculiar combination of characters that will enable it to seize upon a hitherto unoccupied group of contacts and so experience environmental hospitality from the start, although the parent stem from which it developed was also in the same state; much the larger number of the variations however, would experience a hostility so great as to cause extinction.

Such is the course of ordinary morphological development following the changes of the environment and the plentiful instances of extinction are ample evidence that the failure of animal forms to produce their change in time has been no inconsiderable factor. It is not presumed that given sufficient time any form could produce any required change, for we know that many forms in profiting by unoccupied groups of contacts have developed a specialization from which they could never retreat, for so narrow is the line between hospitality and hostility that any change in their environment will render it violently hostile, even to extinction.

Changes in the environment that would produce a hostility of the second type described above (climate, surface, etc.) would be less liable to produce extinction and more liable to result in the survival of slightly changed forms than changes of the first type (other animals). As will be shown below slow changes are ample to account for the process described as mutation by Scott and "definite variation" by Osborn.

Environmental hospitality as defined above is the condition when the sum of any animals contacts with its environment is favorable. It may be discussed under the same two heads as environmental hostility. 1. Contacts with other animals. 2. Other contacts.

The first of these may be reduced to nil. By *environmental isolation* would be expressed the fact that the new form would not come into contact, either actively or passively, with other animals. It is obvious that this condition might occur in regions that were crowded with other animals if the habits or structure of the form permitted it to seize on a group of contacts that were not occupied by some other form, and if it was not an acceptable prey to other animals. This conception is a most useful one as it explains the possibility of the introduction of new forms and their development, even luxuriant development, in regions that are seemingly already crowded.

Environmental isolation may be found immediately by an animal entering a new region or it may be achieved after a period of hostility; after a period of successful competition with other forms in passive hostility, or after a period of active hostility when the predatory form has become for some reason reduced, or by the development of new habits or structures which would render it independent of the other forms. (Environmental isolation might exist in envronmental hostility but it would be rare as it is such a powerful factor on the positive side of environmental hospitality).

There is no thinkable isolation from contacts other than animal.

Environmental hospitality once attained the perpetuation and increase of the animal would be assured. But the very increase of the animal due to the hospitality would introduce a feature of hostility. The often calculated results of the unchecked increase of even the slowest breeding animals show how quickly the possibilities of the hospitable environment would be taxed and the very number of individuals would introduce the factor of passive hostility among animals of the same species. Moreover the increase in numbers would afford the most hospitable field for the development of predatory habits, or the concentrated attacks of hostile factors, as wolves follow herds of deer or buffalo, or diseases attack communities of plants or animals.

Environmental hospitality presents two other phases. 1. *Environmental diversity.* 2. *Environmental monotony.* In the first the sum of favorable contacts includes a great variety of factors as variable climate, diversified surface, complex food supply, etc. The second would be the reverse of this, a simple climate with monotonous surface and simple food supply, such a condition would obtain in the deeper ocean or lake waters, the surface of an ocean or lake far from the shores or the surface of a large plain, plateau or desert.

It is readily seen that a region might be diverse to one form and monotonous to another as a plain might have a variable climate which would be of importance to one form and indifferent to another while the other factors were in common. The two conditions, environmental diversity and monotony would result very differently. In the first the diversity would render it more probable that varieites would find a favorable sum of contacts and so become permanent as species while it would at the same time indefinitely postpone the approach of passive hostility among the individuals for the varieties though more liable to extinction than in a condition of environmental hostility would be less liable than in a condition of environmental monotony.

On the other hand animals developing in a condition of environmental monotony would soon arrive at a condition of overcrowding and passive hostility among the individuals, for the poverty of the environment would place the varieties even in their inception in a condition of hostility while those which bred true to the parent would experience hospitality and survive; the result would be large numbers of individuals of the same species. A good example of this is where animals essentially terrestrial have passed over to an aquatic habit, as the marine reptiles; they are limited in the number of genera and species far beyond the land reptiles. As the varieties would constantly fail and the individuals increase passive hostility would soon supervene and the number of individuals would reach a limit. As it is evident that although the passive hostility might encourage the development of forms the environmental monotony would limit the number; it is possible that we have here the explanation of the survival of archaic forms such as the genus Lingula among brachiopods and the Sphenodon among reptiles.

In an absolutely monotonous environment there would be no possibility of the survival of a variety.

In environmental diversity the hospitality of the region would permit the persistance of a large number of varieties this might be carried to such a degree that the hospitality of the region for a variety might be determined by one minute feature i. e. the animal would be highly specialized or minutely adapted. As the dependence of the Yucca plant on a single species of moth for its fertilization.

Placing the environment of a developing form in the foreground allows of a reinterpretation of several factors of evolution long in use. Such as the Mutation of Scott, the Definite Evolution of Osborn and his Homoplasy; the Vital Principle of various authors. All of these assume that to some extent at least the animals pursue their development independent of the environment, in spite of the environment; that they successfully resist permanent environmental hostility. Williams recognized this in his Biological Geology, p. 35, where he says "When, however, we are led to ask how the adjustments came about in geological time, we have to choose an answer from these two possibilities, viz., either (a) slowly progressing and relatively constant evolution has taken place among organisms constantly struggling together and varying or (b) faunas become rapidly adjusted to new conditions, attaining a biological equilibrium, and then maintain that equilibrium with extremely slight variation for great periods of time, under like conditions, but quickly and rapidly suffer specific modification whenever the environment changes, and the equilibrium is thus disturbed."

Elsewhere in his book he assumes that faunas shift geographically but says that it is "natural to suppose" that new species would develop in the process. This would only be possible if the environment changed in character as well as geographically. That is if a shoreline retreated by elevation of the sea bottom and new species developed in the process it is fair, even imperative, to assume that the shore line has changed somewhat in the character of the bottom, water, temperature, etc.

Mutations or definite evolution can only, from the very nature of the case, appear in the higher taxonomic groups as genus, family, order, etc., and an examination of their characters shows that this is rather more apparent than real. A genus, family, or order is only a group of characters, whose definite variants form the next lower class. As a genus is only a group of characters it can have no definite life, no individuality, and there can be no determinate influence working upon it; it can only exist in the fact that a group of variants, species, unite in having common characters. The species is the nearest possible approach to taxonomic unity, as it is by conception the group having the largest number of common characters; to carry the division one step farther into the individual would result in a wholly natural classification i. e. chaos in our artificial systems. As the species is only a group of individuals profiting by adjustment to a hospitable sum of contacts it follows that the genus exists only in the fact that certain elements in this sum of contacts are common to the group of species. So long as the environment retains a fundamental group of contacts, so long will the species having common characters i. e. the genus, persist. The mutation of a genus is the slow accommodation of a group of species to a fundamental change in the environment while around this play a large number of specific changes due to the less important but more obvious changes in the environment.

Mutations are not in defiance of the environment but a close response to its fundamental most slowly changing elements. Williams in his distinction between mutation and variation does not use this point of view. He says. Bull. U. S. G. S. p. 210, variations are "differences expressed by specimens of the same species —differences arising coincidentally with extension of geographical distribution and changes in condition of the environment." Mutations are "changes of form that are coincident with passage of time, and hence to generational succession ***under conditions of life so nearly the same*** that extinction of the race does not result." This is the idea of Scott's Mutations and Osborn's Definite Evolution; the idea here proposed is that mutation is as much a response to the changing environment as variation but that it is the visible concurrence of different species in a common line of change determined by the fundamental features of the environment and their change.

It is interesting just at this point to examine somewhat the work of DeVries and Burbank in the light of a possible explanation, on this line. DeVries work was, as all know, done on a species of Primrose, some times referred to as the Asses Weed, or Onagrathe (*Oenothera lamarckiana*). This weed was introduced into Europe from Virginia in 1613. Introduced into Holland it soon became acclimated and is cultivated there; it also grows there in a wild and uncultivated state having escaped from gardens. One species the lamarckiana is especially abundant about the city of Hilversum. In 1875 it was noticed that in this district this species showed unusual vigor and remarkable powers of dispersal and multiplied in profusion.

Here is evidently, a case where a species has found a chance to grow to large numbers in a new environment, it has evidently found hospitality; but that the hospitality attained is not absolute is shown by the fact that the species was in a violent state of change, variants being produced in large numbers and indiscriminately for DeVries notes that many of the varieties are evidently less well fitted to survive than the parent. His idea is that the mutation is a period of the species life and independent of environment but its history shows that it is essentially a migrant form in a new environment. He says "ordinarily the principal period of mutation is found at the earliest stage of the species, at the time of its birth, but this is not absolute. However, the phase, or the entire group of phases, of plasticity, is more or less brief in comparison with the rest of its existence." This idea Burbank denies in that he says it is not a period of the species existence but a condition of the species which he claims to be able to produce at will. As quoted by Harwood in the April Century, 1905, Burbank says: "The life forces are constantly pressing forward to obtain any space which can be occupied, and, if they find an open avenue, always make use of it as far as heredity permits." His idea of DeVries mutation is the disturbance of the life processes of a plant by crossing and the resultant confusion of hereditary processes, the inertia of the influence of each parent in the offspring in an automatic attempt to produce characters which were proper for its own environment resulting in abundant sporting.

Both have evidently recognized the disturbed condition of the environment which Burbank has produced and DeVries discovered; the environment of both is changed or changing and the species and individual are responding in the abundant variants.

The most prominent objection to the explanation by this means is that a species in a changed environment does not always produce heterogeneous variants but that they some times vary toward a definite type, new or atavistic.

Under the term Vital Principle has been expressed the idea that a species, genus, family, etc., has a definite span of life comparable to that of an individual; that it has its inception, period of growth, period of decay and death and that this is determined by some force inherent in the group itself. If the fact is kept in mind that the genus and higher are but groups of concurrent characters and have no individual life this idea loses much of its force. If we consider the lowest group, the species, where the idea would have its strongest support it can be shown to be at least gratuitous. The birth of a species is the growth to recognizable quantity of the number of individuals responding to a certain definite group of contacts; having attained environmental hospitality the species increases in number until it reaches the limit of hospitality in the environment and is checked by the concomitant hostile contacts. As the hospitality reaches its limit and hostility intervenes some certain variables will become important as they have the ability to use the same environment as the parent, plus or minus one; but this ability to use the sligthly variant environment determines its success and it becomes an important and fatal element of hostility to the parent as it responds so nearly to the same group of contacts as the parent which must wane as the variable grows. Of course a slight change in the environment might produce the same effect before the animal had matured its own hostility.

The theory of ***continuously improved structure*** is deceptive in statement, the idea is strictly anthropomorphic. There is no theory of ***continuously better adaptation*** for the conditions toward which adaptations tend are continuously changing and the variation is as liable to reverse the previous direction of change as to continue it. If anything, it should be called the theory of more and more perfect differentiation; the response to the smaller and smaller elements in the sum of contacts.

The idea of improvement in the fancied approach to the mammalian and human type may therefore be dismissed. The true statement is that in time forms have become increasingly complex. This increase in complexity is due to the response to increasingly small (in quantity) differences in the sum of contacts of related species or varieties; for instance, the general difference between two groups may be as the difference between 4 and 5 but between two species of one group it may be as the difference between 4.9764 and 4.9765. A difference in the 10000 place may mean a quantitative difference so great as determine the hostility or the hospitality of the environment. A reindeer has four legs but it is almost entirely dependent on reindeer moss for food.

The first is in common with the vertebrates but the last distinguishes it from its nearest ally. The variations permitting the use of new groups of contact thus departs farther and farther from the original structure and the environment appropriate to it. Parasitism and degeneration are just as definitely a following of this law as the attainment of a highly complex structure.

The result may be a peripheral development with strengthening of the new and gradual loss of the old, as a plant which propagates by suckers may be strong at the outer ends but the parent center dead. The classic case of the embryonic gill slits in the mammals illustrates well the final rudimentation of a once fundamental feature while the importance of the mammary glands is an equally good example of the strengthening of the new.

The appearance of fishes, amphibians, reptiles, birds and mammals in order in geological time is no argument for continuous improvement, their inception and flower mark the conquering of a new group of contacts so that almost every variety produced found a hospitable sum of contacts awaiting it. So long as the fishes produced varieties fitted only to breathe in water so long was the possible hospitality of the contacts limited but when a variety was produced which could also breathe the air the possible group of contacts was increased so enormously that almost every variable found a group of contacts hospitable to itself. This statement is not in conflict with the previous one that that environmental hospitality would have a tendency to keep down the establishment of new forms; that would be true where the possibilities of the environment were small but when a whole new realm is conquered, as the air in the case of the first air-breathers, the statement must be reversed until the new region is well filled.

As to the series fish, amphibian, reptile, bird and mammal indicating improvement it would hardly have been suggested had our brains developed in the body of a fish or a parasitic worm, even as now we fail to appreciate the delicate adjustments or the organism of the serpent or the lizard.

An interesting application of the theory arises in the development of the early vertebrates. The first of the air breathers quickly became entirely terrestrial in habit and only later returned to the sea under stress of environmental hostility on the land. Geology teaches that the Carboniferous age, in which the air-breathers first appeared in any prominence, was a time of great transgression of the sea, or great humidity and luxuriance of vegetation; but at the end of the Carboniferous the sea retired and there insued a period of dessication as shown by the salt and gypsum beds, the prevailing red color of the rocks and the lack of wide spread marine deposits. Applying at this point Chamberlins theory that the exposure of land masses with their consequent degradation meant the extraction of large quantities of CO_2 from the air and a subsequent period of refrigeration if not glaciation it will be seen that the advent of the reptiles in the late Carboniferous and the Permian was coincident with the appearance of large land masses and a decided climatic change from that in which the amphibians flourished; almost as great as the change from the habitat of the fish to that of the amphibian. The amphibians had carried their specialization very far in the watery environment but the elevation of the land and its dessication produced a series of new possible contacts which permitted the variables of the amphibians to establish themselves as land reptiles. Then began the wonderful growth of the reptiles in Triassic and Jurassic time which soon so crowded the land that by the middle Trias, the Muschelkalk, when the waters gained a slight ascendency over the earth for a time the variables of the land reptiles returned under new forms to the waters which became crowded with the Nothosaurs, Plesiosaurs and even Ichthyosaurs. With the wide spread Jurassic seas the Ichthyosaurs were abundant and so the Mosasaurs of the Cretaceous seas but just as today, the environmental monotony of the oceanic environment for air-breathing animals kept down the number of variables which established themselves, i. e. the species, though the individuals multiplied beyond number.

THE NUMBER OF YOUNG OF THE RED BAT.

HENRY L. WARD.

At the March meeting I presented before the Society a mounted specimen of the Red Bat, ***Lasiurus borealis***, with four young, calling attention to a previous record, by M. W. Lyon, Jr., in Proc. U. S. Nat. Mus. Vol. 26 pp. 425-426, of this number of young for this species, the article also containing an account of the numbers previously recorded i. e. two having two young and two having three young.

In "Science" N. S. Vol. XXII No. 549 (July 7, 1905) pp. 20-21, I gave a resume of the observations then made, including four by myself, and requesting records from others.

Prof. John L. Sheldon of the Agricultural Experiment Station, Morgantown, W. Va., writes me that when teaching in the Nebraska State Normal School in 1900 some boys brought him a red bat, "as I called it, in distinction from the much darker brown ones, with three young attached to her. The young were about half grown."

Mr. Clyde Fisher, assistant in Biology and Geology in Miami University, Oxford, Ohio, writes me under date of July 17th: "A few days ago I found several red bats (*Lasiurus borealis*) hanging head downwards, by their hind claws, in trees between the gutter and the sidewalks along the streets of our town. I succeeded in capturing a female with *three* young clinging to her."

Recently in overhauling some alcoholic specimens in the basement of the museum an unrecorded preparation of a female Red Bat with four young was found, the label stating that they were taken "early in July, 1899. Donated by H. A. Kirchner."

As the data stood in my notice in "Science," the recorded numbers of cases with their respective number of young was 2x1, 2x2, 3x3 and 2x4. Adding the above mentioned cases to these we have the revised count 2x1, 2x2, 5x3 and 3x4. While these twelve records are far short of what are required for satisfactory generalization they yet have altered the facies of the former tabulation and we now find that four young are more common than is a number smaller than three, of which latter number the table shows a greater preponderance than before.

In "Science" I adverted to the possibility of a bat losing one or more of her young by death or by their accidentally becoming detached. However, as the two instances of two young and two of those having three young were founded on embryological evidence we must find that this species may give birth to as small a number as two offspring.

The average number of young of this as well as of other species of *Lasiurus*, which, with *Dasypterus*, as pointed out by Mr. Lyon, are distinguished from other bats by the possession of four mammæ and the birth of more than the usual one or two young, is still a matter of doubt.

NOTES AND DESCRIPTIONS OF NORTH AMERICAN PARASITIC HYMENOPTERA.

CHARLES T. BRUES.

BETHYLIDÆ.

CHELOGYNUS Haliday.

The six species at present known from North America may be recognized as follows. In addition to these it is probable that several Mexican forms described by Cameron (Biol. Cent. Am. Hymenoptera, p. 444 *et seq.*) under the genus *Dryinus* belong here.

Females.

1. Body entirely black....................................4
   Body wholly or partly ferruginous.......................2
2. Entirely ferruginous, mandibles 4-dentate...........
   ....*ferrugineus* sp. nov.
   In part black...3
3. Head and abdomen black, thorax reddish, mandibles 4-dentate..............................*atriceps* Brues
   Ferruginous, abdomen alone black........*atriventris* Cress.
4. Legs pale rufous.......................................5
   Femora black, except apical part of anterior pair; mandibles 4-dentate...................*grandis* sp. nov.
5. Clypeus pale or rufous, mandibles 5-dentate.*henshawi* Ashm.
   Clyeus black, mandibles 3-dentate........*canadensis* Ashm.

CHELOGYNUS FERRUGINEUS sp. nov.

Female. Length 5 mm. Entirely ferruginous, except for the darker tips of the antennæ and tarsi. Head large, the vertex gently convex, rugoso-punctate, the front below the ocelli longitudinally striate-reticulate. Occiput and cheeks shining, sparsely punctate, margined as are also the eyes. Antennæ ten jointed, the scape slightly shorter than the first flagellar joint, which is two times the length of the pedicel; following joints about equal, two-thirds as long as the first; scape whitish at base below and apical five joints infuscated. Mandibles yellow, with four black teeth. Prothorax shining, finely punctured and covered with short griseous pubescence, a little longer than the mesonotum; the latter polished, with a few punctures and two distinct furrows.

Scutellum and post-scutellum convex, shining, the latter with an oval fovea on each side, the foveæ vertically striated. Metathorax short, abruptly declivous behind, finely reticulated. Abdomen short, oval, stout, polished and impunctured. Legs ferruginous, the anterior femora thickened as usual; first tarsal joint not longer than the following three united; chelæ small. Wings hyaline, with two fuscous bands; the first indistinct, crossing at the tips of the basal cells; second broad, beginning at the stigma and fading out apically and posteriorly. Both basal cells distinct. Stigma pale, oval, marginal cell incomplete.

One specimen labelled Texas. Type in the collection of the American Entomological Society.

This species is readily recognizable by its reddish color. The broad abdomen gives it a very wasp-like appearance, its general habitus simulating that of a small pompilid.

CHELOGYNUS ATRICEPS Brues.

Bocchus atriceps, Brues, Can. Ent. XXXVI, 118.

On re-examination of the type of this species together with a second specimen recently acquired from Wisconsin, I find that the maxillary palpi are five jointed so that the species falls more properly in this genus.

CHELOGYNUS GRANDIS sp. nov.

Female. Length 7 mm. Black, legs in part yellow. Head moderately large, the vertex gently convex, finely rugose; the front below the ocelli with three median raised lines beside the lateral margins around the eyes; sides of face below rufous. Antennæ rufous, the apical five joints blackened; scape scarcely two-thirds the length of the first flagellar joint which is three times the length of the pedicel; second flagellar joint distinctly longer than the third. Mandibles 4-dentate, black, except for a pale band just before the teeth. Palpi fuscous, five jointed. Occiput and cheeks shining, finely punctured and sparsely clothed with white hairs. Prothorax strongly contracted, about equal in length to the mesonotum, marked with a reddish spot at the base of the fore coxæ; pronotum closely punctured. Mesonotum polished, delicately punctulate. Parapsidal furrows very well marked, tegulæ rufous. Scutellum shining, convex. Metanotum short, convex, finely rugulose. Abdomen polished black, narrow and elongate, as long as the thorax. Legs black, except the four anterior tibiæ and tarsi, the base of the anterior trochanters and the tip of the anterior femora. Wings hyaline, with two fuscous bands, the first narrow, just beyond the basal cells, second broad, beginning at the middle of the stigma. Stigma oval, black, pale at base; two basal cells present, radial nervure incomplete although the marginal cell is closed by a delicate indistinct nervure. A discoidal cell is also indicated by very delicate nervures.

One female from Riverside, Mass., collected by Mr. C. W. Johnson and transmitted to me by Mr. H. L. Viereck.

This species resembles *henshawi* Ashm., but is distinct by the darker color of the legs; *henshawi* also lacks the raised frontal lines.

CHELOGYNUS HENSHAWI Ashm.

Bull. U. S. National Museum, No. 45, p. 93.

The color of the clypeus varies considerably in this species. One specimen which I have seen has the latter and the sides of the face below light yellow.

ANTEON Jurine.

ANTEON ANNULICORNIS n. sp.

Female. Length 3 mm. Black, the front legs and antennæ in part yellow, wings bifasciate. Head opaque black, finely scabrous; front with a central and two lateral raised lines; eyes, occiput and cheeks margined, the latter finely punctulate. Mandibles 4-dentate, rufous at base; clypeus punctate. Antennæ piceous, the scape and flagellar joints 3-5 reddish yellow. Scape slightly longer than the pedicel and first flagellar joint together, the latter one-half longer than the pedicel; second flagellar joint equal to pedicel, following joints becoming longer and stouter to the last which is two-thirds the length of the scape. Pronotum shining, about one-half as long as the mesonotum, the latter shagreened and with a few large punctures anteriorly. Parapsidal furrows not indicated. Scutellum short, convex, with a punctate frenum anteriorly and with a few rather stiff black hairs on its disc. Metathorax reticulated, with a transverse carina where it bends down and a few indistinct striations apically. Abdomen short, shining black, the extreme tip rufous. Legs black, except the tips of the anterior femora, anterior tibiæ and tarsi and tips of four posterior tarsi, which are yellow. Chelæ rather small, the first joint of the anterior tarsi no longer than the three following, fourth joint but little longer than the third. Wings hyaline, with a distinct narrow band at the tips of the basal cells and a second wider sharply defined one beginning at the base of the stigma and reaching two-thirds of the way to the wing tip; neither band reaches the posterior margin of the wing. Stigma black; the stigmal vein as long as the stigma, knobbed at the tip.

Described from a female specimen from Mexico, collected by Mr. E. A. Schwartz. Type in the collection of the American Entomological Society.

This species comes near to Cameron's ***Dryinus albitarsis*** (Biol. Cent. Am. Hym. 447.) but is distinct by its annulate antennæ and different sculpture.

COSILIDÆ.

SIEROLOMORPHA Ashm.

This peculiar Cosilid genus is represented by but a single species which occurs in the United States, previously known only in the male sex.

In a lot of Bethylids recently received from Mr. H. L. Viereck there are a large number of males and two female specimens.

The female differs from the male by its more strongly thickened femora and stout tibiæ, and by the incrassated antennæ which are only 12 jointed (13 jointed in the male). The head and thorax are more shining, being very highly polished. The legs, except coxæ, are ferruginous.

The single species, *S. ambigua* Ashm. (Bull U. S. N. M. 45, 56) is widely distributed. I have seen specimens from New Hampshire, Connecticut, Massachusetts, Georgia, and Vancouver.

PROCTOTRYPIDÆ.

DISOGMUS OBSOLETUS sp. nov.

Female. Length 2.5 mm. Black, more or less brownish, shining; legs brownish yellow. Head transverse, about two and one-half times as wide as long antero-posteriorly; smooth and polished above, front prolonged below forming a strong carina between the antennæ; eyes large and convex, sparsely hairy. Lower part of face roughly sculptured, brownish; mandibles rufous, palpi pale yellow. Antennæ slightly longer than the head and thorax, brownish yellow, darker apically and at the incisures. Scape sub-globose, pedicel very small, only about one-third the length of the first flagellar joint; second flagellar joint two-thirds the length of the first, about twice as long as wide; following joints subequal to second, except last which is nearly twice the length of the penultimate. Mesonotum with indications of parapsidal furrows near its anterior margin, elsewhere shining and convex, impunctured. Scutellum as usual, with a deep groove at its base. Tegulæ yellow. Metathorax brownish yellow, with a median carina which extends almost to the base of the petiole and a lateral carina on each side, the three connected across the top of the posterior face by a transverse carina; elsewhere coarsely reticulate. Abdomen as long as the head and thorax together, cauda one-third as long as the abdomen. Petiole brown, about as wide as long, rugosely sculptured. Abdomen piceous brown lighter basally and yellow; cauda yellow at base, black at tip. Legs brownish yellow, tips of tarsi blackish; posterior tibial spurs weak. Wings brownish hyaline; the stigma long, with parallel sides, pointed at tip, four times as long as wide. Stigmal vein short, marginal cell a little longer than the stigma, triangular. Discoidal veins very faintly indicated by fuscous streaks.

One female, Morris Cove, Conn., May 20, 1904, received from H. L. Viereck.

The present species differs from the more typical forms of *Disogmus* in having only slight indications of mesonotal furrows. The venation agrees much more closely with this genus than with *Proctotrypes* however, and I am led to place it here.

DIAPRIIDÆ.

GALESUS VIERECKII sp. nov.

Male. Length 3.5 mm. Black, the first three antennal joints brown, legs, except coxæ, rufous yellow. Head shining, impunctured, sparsely clothed with long pale hairs; convex above, flat beneath; front projecting just in front of the anterior ocellus, the margin of the projection toothed laterally and sinuate medially; prominence below antennæ rounded-truncate, deeply emarginate medially. Antennæ 14 jointed, reaching to the middle of the abdomen; scape, pedicel and first flagellar joint rufous, remainder piceous black; scape thickened, angulated beyond the middle; pedicel and first flagellar joint both very small, together shorter than the second flagellar joint, the pedicel stoutest; second and following flagellar joints about equal, decreasing in thickness, last a little longer and pointed. Mouthparts rostriform, black; tips of palpi testaceous. Collar thickly white hairy.

Mesonotum shining, impunctate, with two deep furrows. Scutellum with two large oblique, oval basal foveæ; grooved laterally behind, its posterior margin crenate, straight; postscutellum with a median and lateral carinae. Metathorax with an A-shaped series of carinæ, the upper triangular portion very small, its surface rugose, shining, the posterior angles produced. Abdomen clavate, polished; petiole coarsely fluted, pale hairy; second segment at base with three short, deep sulci, very long, the remaining segments barely projecting beyond it. Genitalia projecting as three rufous prongs. Legs ferruginous, the coxæ black. Wings entire, not emarginate at apex; submarginal vein terminating some distance from the costal margin in an oval, brownish, stigma-like spot; basal veins pale brown.

One male from Colebrook, Conn., July 21, 1905.

Named in honor of my friend Mr. H. L. Viereck, to whose kindness I owe many interesting species of Proctotrypids.

LOXOTROPA MODESTA sp. nov.

Female. Length 1.5 mm. Black, with legs and antennæ, including the club, reddish. Head shining black, not angulated above the eyes. Antennæ rufous, the scape as long as the club, but shorter than the funicle. Pedicel about one-third as long as the scape and slightly longer than the first and second flagellar joints together; second to fifth flagellar joints about equal, shorter than the first and narrower than the sixth and seventh. Club of the usual shape, brown; its joints of equal length, the second quadrate. Posterior surface of head delicately transversely aciculated. Thorax shining black, the tegulæ and metathorax rufous. Scutellar fovea not extending across the entire base, rather deep; the lateral grooves wanting. Upper surface of metathorax slightly darkened, without any central carina, its posterior margin strongly emarginated, the lateral angles continued into prominent teeth. Petiole of abdomen rufous; wooly. Second segment very long, polished. Wings pubescent, very faintly tinged with brownish.

Described from a single female collected at Lehigh Gap, Pa., July 13, 1900 and transmitted to me by Mr. Henry L. Viereck.

The present species is related most closely to *L. abrupta* Thoms. and *L. californica* Ashm., but differs from both in the form and color of the antennæ and sculpture of the scutellum.

Public Museum, Milwaukee,
Oct. 26, 1905.

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BULLETIN

OF THE

Wisconsin Natural History Society

VOLUME IV
(NEW SERIES)

WITH TEN PLATES

MILWAUKEE
1906

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Anat

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 4, New Series. APRIL, 1906. Nos. 1 and 2.

PROCEEDINGS.

October 26, 1905.

Regular monthly meeting of the society.

President Teller in the chair and about 150 persons present.

The minutes of the last regular meeting were read and approved.

Mr. H. L. Ward reported that the first proof for the forthcoming Bulletin of the society had just been received, having been delayed. He moved that title pages and indices be prepared for the past numbers of the Bulletin of the new series. Motion carried.

Mr. Ward then presented the resignation of Mr. C. E. Monroe as general secretary, which was accepted. Mr. C. T. Brues was elected to fill the vacancy.

The names of Miss M. C. Denton, Mr. N. T. Nichols, and Mr. Herbert Clowes were presented for membership, and subsequently passed upon favorably by the board of directors.

President Teller called the attention of the society to the death of Mr. Adolph Meinecke, and on motion of the society appointed a committee consisting of Messrs. Peckham, Bartlett and Ward to draw up suitable resolutions.

The society then listened to an illustrated talk by Mr. C. T. Brues, of the Public Museum, on "Ant and Termite Guests." The speaker called attention to the peculiar relations which exist between many ants and termites, and various insects which are adapted to live in the nests of these social insects. A classification of such forms based upon the extent of interdependence was reviewed and various characteristic modifications discussed. The matter was then taken up in detail, referring to special species with the aid of lantern slides.

November 23, 1905.

Regular monthly meeting of the society.

President Teller in the chair.

The minutes of the last monthly meeting were read and approved.

Dr. Peckham reported that the committee appointed to draw up resolutions regarding the death of Mr. Meinecke was not yet ready to report.

Mr. Ward proposed the names of Mr. Chas. Doerflinger, Mr. A. Monsted and Mr. George Shrosbree for membership in the society. They were subsequently elected by the board of directors.

L. Soc. 120. W3. 16

There being no further business, the society then listened to a lecture by Dr. S. Graenicher on "The Mutual Relations of Flowers and Insects."

Dr. Graenicher traced briefly the history of the subject and showed the great importance to both flowers and insects of these adaptations. Many plants are absolutely dependent on insects for the fertilization of their flowers, while many insects are no less dependent on nectar and pollen for food. By means of lantern slides he showed many of the remarkable adaptations in members of both groups whereby insects are attracted to plants; how the pollen is transported; and cross-pollination affected; also how some plants are visited only by certain species of insects. The peculiar relations of orchids and yuccas to insects was discussed in detail.

December 28, 1905.

Regular monthly meeting of the society.

President Teller in the chair and about 35 persons present.

A request to exchange publications with the museum of Magdeburg was allowed.

There being no further business, Dr. G. W. Peckham addressed the society on "Some Color Problems in Relation to Natural History."

Dr. Peckham called attention to the inadequacy of the theory of natural selection to account for many remarkable cases of coloration among animals. He outlined briefly the origin and development of the theory of sexual selection, showing the manner in which it acts.

The structure and coloration of a large number of male Attid spiders was discussed at length, and the fact pointed out that in each case the peculiarities of coloration were clearly correlated with the courtship actions of the males during the mating season. This was illustrated by a large series of colored charts of the spiders. After some discussion on the part of the speaker and several members, the meeting adjourned.

January 26, 1906.

Regular monthly meeting of the society.

President Teller in the chair, and about a hundred persons present.

The society voted to exchange publications with the Sociedad Cientifica de Sao Paulo, Brazil.

An invitation from the Academy of Sciences of St. Louis was read, requesting the presence of a delegate from the society to be present at the celebration of the fiftieth anniversary of its foundation.

Dr. George P. Barth was named for membership in the society and subsequently elected by the directors.

Mr. John E. Burton then gave an extended talk on "The Two Alaskas," describing the Eskimo peoples and their customs and industries. The speaker had spent several years in Alaska and described many characteristics of the country and its inhabitants that are not ordinarily known. At the close of the talk a representative collection of Alaskan ethnological specimens was exhibited.

March 1, 1906.

Regular February meeting, which had been postponed one week.

President Teller in the chair and about one hundred persons present.

The name of Mrs. Albert F. Gallun was proposed for membership, and she was subsequently elected by the board of directors.

There being no other business, Dr. E. C. Case addressed the meeting on "The Ancestry of Dogs and Cats," dealing with the origin and differentiation of the various domesticated races from wild species.

Dr. Case referred to the phylogeny of the Canidæ and Felidæ, showing the lines of divergence during past ages, more especially in relation to the skull and dentition. He also described the characteristics of a large number of varieties of dogs and cats and their wild relatives. The discussion was illustrated by stereopticon slides.

March 29, 1906.

Regular monthly meeting.

President Teller in the chair and about fifty persons present. The general secretary not being present, Mr. Carpenter was elected secretary pro tem.

Miss Minna C. Denton, of the Milwaukee-Downer College, gave the talk of the evening on "The Work of Professor Jacques Loeb," a resumé of some recent investigations concerning the physiology of the nervous system, and the artificial parthenogenetic development of animals.

Professor Loeb's book, "Physiology of the Brain," elaborates and enforces the segmental-reflex theory as opposed to the centre-theory, *i. e.*, emphasizes the independence of spinal centers and those in the lower brain, considers that the cerebral hemispheres are probably a mechanism developed for the purpose of associative memory, and disavows theories of localization of function in the cerebral cortex.

The work in artificial parthenogenesis includes experiments with many Echinoderms, a number of Annelid worms, and several mollusks, in which the fertilizing agency was usually either an increase in concentration of the sea-water, or the addition of some specific chemical substance. Experiments which resulted in the fertilization of the sea-urchin's egg by the sperm of various species of starfish, or of a Holothurian, were also mentioned.

A TURTLE PIPE FROM WISCONSIN.

BY HENRY L. WARD.

The Public Museum of the City of Milwaukee has recently obtained by purchase an effigy pipe representing with considerable accuracy a turtle such as may be found in our streams and ponds.

In his important and most interesting monograph on "The Aboriginal Pipes of Wisconsin" Mr. West describes and figures another "turtle pipe" which is also the property of the Public Museum, received by gift in 1883 from the Wisconsin Natural History Society. This pipe was, according to record, collected on the grounds of the House of Correction within the limits of the City of Milwaukee, by Hugh McGarry. The identification of it as a turtle is rather a matter of elimination than because of a close approximation to any known species of turtle.

It is more nearly like a turtle than it is like any other kind of animal, but the number and the disposition of the raised scutes covering the carapace do not agree with those of any turtle and much less do the similar raised scutes, arranged in longitudinal rows alternating with raised bands, covering the head bear a close resemblance to the armature of that portion of a turtle. It is without eyes, limbs or tail, and bears upon its back a shuttle-shaped decoration through the center of which was made the excavation of the bowl. The posterior part of the body is truncated, with no projecting stem, and Mr. West believes that it was "used without the addition of a detachable mouth-piece." The lower surface is left blank. If, as is probably the case, it represents a turtle it is probably a conventionalized figure of a box or wood tortise with feet retracted and tail folded under the carapace. Of it Mr. West writes: "[it] is believed to be the only ceremonial pipe of turtle form, so far found in Wisconsin."*

The pipe now under consideration is unmistakably the representation of a turtle notwithstanding that the plates of the carapace do not agree in arrangement with those of any species; and although their shapes and the general form of the body would indicate that one of the *Emydidæ* was meant the plastron does not approximate the form found in that family but is suggestive of the

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* West, Geo. A., Wisconsin Archeologist, Vol. 4, Nos. 3 and 4, p. 101-102 (1905).

Chelydridæ. The entire absence of marginal scutes to the carapace is a noticeable omission. The eyes had been carved; but most of the right one has been lost by a cleavage of part of the head and the surface of this cleavage has been subsequently finished by pecking. The right hind foot shows four toes, the other feet are not digited.

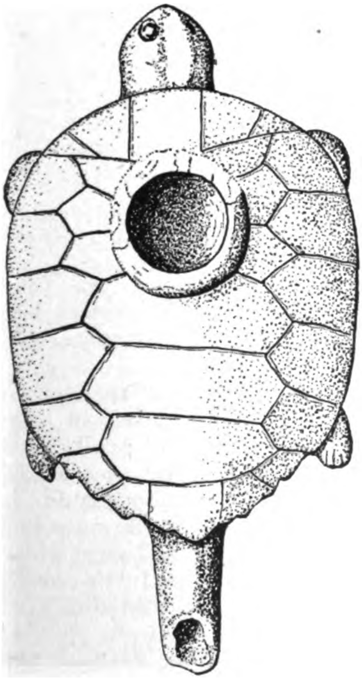
The Indian who carved this pipe was unquestionably familiar in a general way with some turtle and perhaps from the abundance of his knowledge, and with a lack of scientific accuracy united members of two families (probably the Painted turtle or Mud turtle and the Snapping turtle) in one individual.

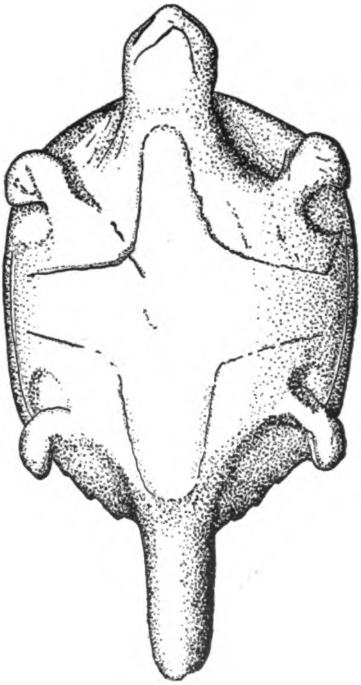
This pipe was recently acquired by purchase, through her son, of Mrs. Merrill of Burnett Junction, Dodge County, Wis., in whose possession it had remained since it was plowed up in 1876 on the A. G. Young farm at that town. It was a surface find, the nearest Indian mounds being about a mile distant.

The accompanying illustrations obviate the necessity of a detailed verbal description. The pipe weighs 9 ounces and is carved from compact reddish brown argellite, finely laminated parallel to the plane of its major diameters. It is 122 mm. ($4\frac{13}{16}$ inches) long, 30 mm. ($1\frac{5}{32}$ inches) in thickness through the body, with a raised rim to the bowl averaging about 5 mm. ($\frac{3}{16}$ inches) in height. The forward half of this rim had been broken away when found. The tail formed the stem and has been broken away leaving its extreme length, from the posterior point of the carapace, 27 mm. ($1\frac{1}{16}$ inch). The original length is indeterminable. The stem hole is 5 mm. ($\frac{3}{16}$ inch) in diameter, practically circular in section, showing longitudinal grooves and pitting the cavity of the bowl close to its bottom on the side opposite to its entrance, showing that it was over-bored. The bowl is 19 mm. ($\frac{3}{4}$ in.) in diameter at the top, practically circular in transverse section, constricting to the hemispherical bottom. It measures 30 mm. ($1\frac{5}{32}$ in.) in depth from the top of the raised rim. The lower two-thirds of the bowl cavity shows both vertical and horizontal scratches not obliterated, apparently because of their depth, by the smoothing and polishing process to which it has evidently been subjected and which has left the upper third quite smooth. The surface of the turtle has been smoothed and polished but not to the extent of removing all traces of the pittings made in pecking it into form.

Since finding, some one has re-scratched the suture lines on the carapace about two of the scutes; but fortunately not to an extent to entirely obliterate the original surfaces of these grooves and render questionable whether any of the lines are recent interpolations. On the two scutes of the carapace immediately posterior to the left fore foot, on the lower surface between the left hind foot and the tail and on the right of the neck, are scratches left by a metal tool, probably by a knife in the hands of someone testing the hardness of the stone. These are very evidently blemishes of recent date. The original surface of the pipe shows no indication of the use of metal implements in its manufacture but has very evidently been pecked into shape and then rubbed down. It is a remarkably faithful representation of a generalized turtle with enough departure from any particular kind of turtle to render it characteristic of the careless art of the Indian.

As the turtle was an animal much used by the Sioux both in old and recent times and Burnett Junction is but 25 miles from the shores of Lake Winnebago, where it is known that the Siouan tribe of Winnebagos dwelt, there is much probability that this is a Winnebago pipe.





SOME NOTES ON THE POLLINATION OF FLOWERS.

BY S. GRAENICHER.

JEFFERSONIA DIPHYLLA (L.) PERS. AND SANGUINARIA CANADENSIS L.

The flowers of the twin-leaf (*Jeffersonia diphylla*) and bloodroot (*Sanguinaria Canadensis*) are among the most conspicuous of our early flowers of spring. Although representing two quite distinct families, these flowers have from an ecological point of view several features in common, and for the sake of comparison they are considered together. Sanguinaria is a rather frequent plant in our region, while of Jeffersonia it must be stated with regret that it is gradualy disappearing from the immediate surroundings of Milwaukee. The observations recorded below were made on the southwestern slope of a hill in the Menomonee Valley between Milwaukee and Wauwatosa. In this particular locality the two plants occur close together, the flowers of the bloodroot always appearing two or more days in advance of those of the twin-leaf. In size and general appearance these two flowers resemble each other to such an extent that they are not easily distinguished at a distance. Both are typical pollen-flowers, not a trace of nectar being produced by either of them.

JEFFERSONIA DIPHYLLA (L.) PERS. TWIN-LEAF.

Altogether two species of Jeffersonia are known, one from Manchuria in Eastern Asia, and the other from the eastern part of North America. Nothing has been reported so far concerning the pollination of either of them.

The earliest flowers of our species, *I. diphylla,* make their appearance as a rule during the fourth week in April. In 1900, for example, the flowering season extended from April 26 to May 13. The solitary white flower has a diameter of 4 to 4½ cm., and is situated at the end of an erect scape about 2 dm. in length. The sepals fall off very early, mostly before the spreading of the 8 petals. The latter are about 2 cm. long and pure white, while the sepals and scape have a purplish tint. In the newly opened flower the 8 stamens are directed away from the pistil. They have a length of 11 mm., 8 mm. of which are to be credited to the anthers. The pistil is equally as long as the stamens, and carries a flattened stigma on top of a short style.

The opening of the flower begins late in the forenoon, somewhere between 11 and 12 o'clock, and a short time afterwards one of the anthers begins to shed its pollen. One by one the extrorse anthers open, and on the afternoon of the first day dehiscence has taken place in all of them. The flower is homogamous, the stigma being receptive from the start. The mode of dehiscence is peculiar. The outer wall of the anther represents a valve that at first becomes detached at the base, and gradually becomes separated along the entire length of the anther, but remains connected at the tip. During this process the slender ribbon-shaped valve curls up on itself and turns its inner surface covered with pollen outward. Finally each anther carries such a curl covered with pollen at its tip. Around 4 o'clock in the afternoon the flower closes, the anthers are pressed up against the pistil, and some of the pollen is brought in contact with the stigma. In favorable weather the flower opens again on 2 or 3 consecutive days, always closing for the night or in rainy weather, and from the second day on the withered valves with the remnants of dry pollen surround the stigma. At the end of the third or fourth day the petals are dropped. The flower is devoid of nectar, it possesses a very faint sweet odor, and does not seem, according to my observations, to be as attractive to insects as its neighbor, the bloodroot.

On the first day cross-pollination may be effected by the visits of insects, but if this fails to take place self-pollination is insured by the closing of the flower in the evening.

The following insects have been noticed on the flowers:

A. BEES. *

Apidæ: (1) *Ceratina dupla* Say female, c. p.; Andrenidæ: (2) *Andrena hippotes* Rob. female, c. p.; (3) *Halictus coriaceus* Sm. female, c. p.; (4) *H. foxii* Rob. female, c. p.; (5) *H. zephyrus* Sm. female, c. p.; (6) *H. tegularis* Rob. female, c. p.; (7) *H. nearcticus* Vach. female, c. p.; (8) *H. anomalus* Rob. female, c. p.; (9) *Augochlora confusa* Rob. female, c. p.

B. FLIES.

Syrphidæ: (10) *Syrphus ribesii* L., alighting on the middle of the flower, not f. p.

The most regular visitors are small bees of the genus *Halictus*.

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* For present purposes I prefer to retain the previous classification of bees and divide them into *Apidæ* (long-tongued bees), and *Andrenidæ* (short-tongued bees).

While collecting pollen they usually do not come in contact with the stigma, and for this reason are not likely to bring about self-pollination. When proceeding from flower to flower and landing in the middle of a flower on the stigma their visits are apt to result in cross-pollination.

SANGUINARIA CANADENSIS L. BLOODROOT.

Loew (1) published the results of his observations on specimens cultivated in the Botanical Garden of Berlin, and Robertson (2) gave an account of the pollination of this flower growing under natural conditions in Southern Illinois. The flowers of this species as observed in our surroundings agree in a general way with those described by Robertson. The two sepals fall off quite early, and the 8 or exceptionally 9 petals spread and form a showy white flower with a diameter ranging between 4 and 5 cm. These flowers often grow together in small groups and this adds considerably to their conspicuousness. Each flower is borne by a scape 12 cm. high. The two-parted stigma becomes receptive as soon as the flower opens, but the anthers empty their pollen only from the second or third day on (proterogyny). The numerous stamens are directed outwardly. They differ in length, the outer ones being rather short while those next to the pistil are of sufficient length to reach the stigma. In the older flowers the stigma assumes a brownish color and withers.

No nectar is produced, but insects find an ample supply of pollen. The larger among the visitors (bees and Syrphid-flies) when alighting on the flower often come in contact with the stigma. Such a visit during the first 2 or 3 days results in cross-pollination in most instances. The flower closes towards the evening, and by forcing the dehiscent anthers of the inner row against the stigma self-pollination may be accomplished as a last resort if the stigma be still receptive. But in our region the flowers are sufficiently visited to make cross-pollination, or at least self pollination through insect agency the probable outcome. Visitors were taken as follows:

A. BEES.

Apidæ: (1) *Bombus separatus* Cr. female, c. p.; (2) *Nomada*

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1. Loew. Bluetenbiologiche Beitraege 1. Pringsh. Jahrb. XXII. 1891, pp. 453-454.

2. Chas. Robertson. Flowers and Insects, VIII. Bot. Gaz., XVII., 1892, pp. 175-176.

sayi Rob. female, searching for honey; (3) *Ceratina dupla* Say female, c. p.; (4) *Zadontomerus tejonensis* Cr. male, searching for honey; Andrenidæ: (5) *Andrena vicina* Sm. male, female in cop., female, c. p.; (6) *A. milwaukeensis* Græn. female, c. p.; (7) *Halictus lerouxii* Lep. female, c. p.; (8) *H. nearcticus* Vach. female, c. p.; (9) *H. zephyrus* Sm. female, c. p.; (10) *H. sparsus* Rob. female, c. p.

B. FLIES.

Bombyliidæ: (11) *Bombylius major* L., probing around the bases of the filaments for nectar; Syrphidæ: (12) *Syrphus americanus* Wied., f. p.: (13) *Mesogramma marginata* Say, f. p.; (14) *Crioprora cyanogaster* Loew, f. p.

C. BUTTERFLIES.

Rhopalocera: (15) *Pontia rapae* L., 1 specimen alighting on the flower. An exceptional visitor.

In Southern Illinois the honey-bees visit these flowers in such numbers as to drive the other visitors away, and for this reason Robertson was not able to observe more than 3 bees (Halictus), 1 Syrphid-fly, and 1 beetle, at the flowers. He considers bees of the genera Andrena and Halictus, and flies of the family Syrphidæ as the normal visitors. Our observations around Milwaukee support his views. In our neighborhood the honey-bee is not of so frequent occurrence as to interfere to any extent with the native visitors of our flowers.

The flowers of Jeffersonia, as also of Sanguinaria appear before the green leaves of these plants are fully developed, and before the leaves of the surrounding plants have become visible. For this reason the large white flowers stand out very prominently against the background of the woodlands in early spring. They are in competition with each other for the attention of the same set of visitors, mainly Andrenidæ and Syrphidæ, and to these they offer pollen only. Wherever these flowers occur in sufficient numbers to be attractive to those insects they undoubtedly succeed in obtaining cross-pollination for the majority. If in Jeffersonia insects fail to effect cross-pollination or at least self-pollination on the first day, then the flower closing for the night insures spontaneous self-pollination by the aid of a characteristic contrivance. In Sanguinaria spontaneous self-pollination is not brought about so early, it is resorted to rather late after the visitors have had ample time to transport pollen to the stigma.

HAMAMELIS VIRGINIANA L. WITCH-HAZEL.

This shrub is a common inhabitant of our woods, and is remarkable from the fact that late in the fall the flowers appear together with the mature seeds of the previous year. It begins its flowering season later than any of our plants, and, as a rule, after the leaves have fallen, although the first flowers on some specimens may appear at the end of September when the leaves are still present. It has been noticed in blossom from September 26 on. The latest flowers are usually destroyed by the advent of cold weather around the beginning of November.

Meehan (3) has given a description of the flowers with their long, slender, yellow petals. They are very numerous, and emit a peculiar resinous odor. The shape of the flower represents a small cup formed by the 4 rigid sepals. Alternating with these the 4 ribbon-shaped petals protrude from the cup, and the 4 stamens alternating with the petals are very short. The wall of the anther-cell (valve) splits open below, and turns upward and somewhat inward thereby exposing the pollen. Inside of the stamens and alternating with them are the 4 oblong staminodia, scale-like organs bending outward towards the petals, and secreting fine drops of nectar on their upper surface, especially near the apex. The two styles with their red-tipped stigmas are directed outward.

Meehan states that the flower is homogamous, and that the stigma becomes receptive on the second day at the same time that the anthers begin to dehisce. In the specimens examined in our region the stigma was receptive already on the first day, and remained so for a day or two after dehiscence had taken place. We are therefore dealing with proterogyny.

Two anthers situated diagonally opposite to each other are only 2 mm. apart, but they do not touch the stigma, and consequently spontaneous self-pollination can hardly occur in this manner. The only way it can take place is by the falling of pollen on the stigma of flowers in a vertical position. Meehan did not witness any insect visits, and the question was left open whether the pollen was transported from flower to flower through insects (entomophilous) or through currents of air (anemophilous). The structure of the flower seems to me to leave no doubt as to its entomophilous character. The conspicuousness of the enormously

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3. Thomas Meehan. Contributions to the Life Histories of Plants. No. V, Proc. Ac. Nat. Sc., Phil., 1890, pp. 273-274. Cited by Loew in Knuth's Handbuch d. Bluetenbiologie III, Part 1, pp. 333-334.

developed yellow petals, the distinct odor, and above all the nectar-secreting staminodia (not mentioned by Meehan as cited by Loew point to an adaptation to insects. The list of visitors offered below gives evidence of a rather numerous and varied gathering of insects at the flowers, and shows the prominent part taken by flies, since 75% of the 44 visiting species belong to this order.

A. HYMENOPTERA.

Vespidæ: (1) *Vespa germanica* Fabr. s.; Braconidæ: (2) *Microgaster* sp.; Chalcididæ: (3) *Elachistus cacœciæ* How., s.; (4) *Eutelus* (*Pteromalus*) *onerati* Fitch., s.

B. DIPTERA.

Bibionidæ: (5) *Bibio gracilis* Walk.; Phoridæ: (6) *Hypocera femorata* Meig.; Platypezidæ: (7) *Platypeza tœniata* Snow; Syrphidæ: (8) *Chrysogaster nitida* Wied.; (9) *Syrphus americanus* Wied.; (10) *S. ribesii* L.; (11) *Allograpta obliqua* Say.; (12) *Mesogramma geminata* Say; (13) *Sphærophoria cylindrica* Say; (14) *Eristalis tenax* L.; (15) *E. transversus* Wied.; (16) *Syritta pipiens* L.; Tachinidæ: (17) *Phorantha occidentis* Walk.; (18) *Oestrophasia ochracea* Bigot; (19) *Frontina* sp.; Sarcophagidæ: (20) *Sarcophaga helicis* Town.; (21-22) *Sarcophaga spp.;* Muscidæ: (23) *Pollenia rudis* Fabr.; (24) *Chrysomyia macellaria* Fabr.; (25) *Lucilia cæsar* L.; (26) *Morellia micans* Macq.; (27) *Pseudopyrellia cornicina* Fabr.; (28) *Musca domestica* L.; (29) *Stomoxys calcitrans* L.; Anthomyidæ: (30) *Phorbia fusciceps* Zett.; (31-32) *Phorbia* spp.; (33) *Cœnosia fuscopunctata* Macq.; Scatophagidæ: (34) *Scatophaga squalida* Meig.; Sepsidæ: (35) *Sepsis violacea* Meig.; Oscinidæ: (36) *Chlorops assimilis* Macq.; Sapromyzidæ: (37) *Lonchæa polita* Say—all s. or f. p.

C. LEPIDOPTERA.

Heterocera: (38) *Laphygma obscura* Riley; (39) *Heliophila unipuncta* Harv.; (40) *Cucullia asteroides,* Gn.; (41) *Autographa brassicæ* Riley; (42) *Heliothis obsoleta* Fabr.—all s.

D. COLEOPTERA.

Carabidæ: (43) *Lebia scapularis* Dej.; Chrysomelidæ: (44) *Diabrotica vittata,* Fabr.—all s.

The pollen is deposited mostly on the mouth-parts of the visitors. At the beginning of the blooming period before the leaves have fallen, the few flowers are not likely to attract much attention, and in fact are poorly visited. Besides, competition is decidedly severe at this time on account of the multitude of other flowers (Compositæ, etc.). But later on, especially in the latter half of the month of October, when most of the leaves of the witch-hazel have disappeared, there is a very pronounced contrast in color between the numerous yellow flowers of this plant and its environment. And this is the time when the flies pay the most attention to the flowers. On two different occasions in the evening following a warm day, and soon after sunset, quite a number of moths appeared on the flowers, as represented by the 5 species of the list.

By coming at the end of the season after the leaves have fallen the flowers of the witch-hazel secure a similar advantage as do the flowers of the bloodroot, twin-leaf and some other species by appearing early in the spring ahead of the leaves.

PARNASSIA CAROLINIANA, MICHX. CAROLINA GRASS OF PARNASSUS.

A widely distributed representative of the genus *Parnassia, P. palustris,* a plant inhabiting Europe, Asia and the northern portion of North America, has been studied by many ecologists of Europe on account of the peculiar structure of certain parts of its flower. Inside of, and opposite to each of the showy white petals a staminodium is present with a flattened and widened basal portion, and numerous (7 to 13 or even 25) slender processes protruding from its outer margin. Nectar is contained in two shallow depressions on the basal part, but the shining knob-shaped tips of the processes, although appearing as drops of nectar are entirely dry. These latter have been explained by Hermann Mueller as organs of glandular structure serving no other purposes than to attract visitors to the flowers. According to H. Mueller (4) "we have thus in *Parnassia palustris* a very well-marked example of a *deceptive flower,* which deludes the foolish flies by displaying a multitude of conspicuous but sham drops of honey; and which, after thus alluring them, affords them indeed some easily accessible honey, which repays their trouble, but is quite incommensurate with the apparently bountiful display." Mueller also informs us that his son witnessed a fly (a species of *Eristalis*) licking these drop-like glands in search of

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4. H. Mueller. The Fertilisation of Flowers, transl. by D'Arcy W. Thompson.

honey. Knuth (5) does not consider it appropriate to call such a flower a deceptive flower, since it does not deceive its visitors, but offers them at least as much nectar as the average umbelliferous flower.

Parnassia Caroliniana, the species represented in the flora of Milwaukee County, blooms from about August 20 to October 4. It may be met with in damp localities throughout our region, but nowhere have I seen it growing in such profusion as in some places on the bluffs along the shore of Lake Michigan, as for example in the vicinity of Whitefish Bay, at South Milwaukee, etc. There is in this species a solitary flower at the top of a smooth scape of 3 to 4 dm. length, and the parts of the flower are all white, except the dark-green ovary. The newly opened flower has a diameter of 2½ cm., but by gradual growth this is increased to 4 cm. in the older flower. We are presented here, as in *P. palustris,* with a typical example of proterandy. When the flower opens the 5 stamens in different stages of growth lean up against the conical ovary, the latter is not full grown, and very little is to be seen of the undeveloped stigma. The most advanced stamen becomes longer, and places its extrorse anther on top of the ovary immediately above the stigma. After it has discharged its pollen the stamen is bent outward between the two corresponding petals, and another anther takes its place on top of the ovary. One by one the 5 anthers get rid of their pollen, and move out of the way. This period of the flower's existence represents the first or staminate stage, and is succeeded by the second or pistillate stage in which the stigma with its 4 or 5 divisions reaches its full development, and becomes receptive. Five staminodia are also present as in *P. palustris,* but they are more simple in structure than in that species. Each staminodium has a smaller basal part, and sends off only 3 knob-tipped processes of equal length. There are no depressions serving as nectaries, and only a scant supply of nectar is secreted on the basal part, and in the lower region of the processes. The yellow shining glands at the tips of the processes resemble drops of liquid, and are arranged in a circle of 8 to 12 mm. diameter (according to the size of the flower) around the ovary. The staminodium in *P. palustris* represents a higher degree of development than that in *P. Caroliniana,* as demonstrated by the greater number of glandular tips, and the more complex nectar-secreting

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5. P. Knuth. Blumen und Insekten auf den Nordfriesischen Inseln, 1892, pp. 34-35.

apparatus. Otherwise the flowers of both species agree very closely. Proterandry to such an extent as it exists in both of them makes cross-pollination the only probable outcome.

I have taken the following insects on the flowers of *Parnassia Caroliniana*:

A. HYMENOPTERA.

Apidæ: (1) *Apis mellifera* L. worker, s.; (2) *Bombus affinis*, Cr. worker, s.; Andrenidæ: (3) *Andrena parnassiæ* Ckll., female, s. and c. p.; (4) *Halictus zephyrus* Sm. female, s. and c. p.; Ichneumonidæ: (5) *Lampronota frigida*, Cr. s.; (6) *L. americana* Cr., s.

B. DIPTERA.

Bombyliidæ: (7) *Anthrax alternata* Say; Syrphidæ: (8) *Paragus bicolor* Fabr.; (9) *Melanostoma mellinum* L.; (10) *Syrphus americanus* Wied;. (11) *Allograpta obliqua* Say; (12) *Mesogramma polita* Say; (13) *Sericomyia chrysotoxoides* Meig.; (14) *Eristalis tenax* L.; (15) *E. dimidiatus* Wied.; (16) *Helophilus similis* Macq.; (17) *Syritta pipiens* L.; Tachinidæ: (18) *Exorista nigripalpis* Town;. (19) *Phorocera doryphoræ* Riley; Muscidæ: (20) *Lucilia cæsar* L.; (21) *Musca domestica* L.; Anthomyidæ: (22) *Leucomelina garrula*, Gig.—Tos.; (23) *Anthomyia* sp.; (24) *Phorbia fusciceps* Zett.—all s. or f. p.

C. LEPIDOPTERA.

Rhopalocera: (25) *Pyrameis huntera* Fabr. s.; (26) *Pontia rapæ* L. s.

The most important pollinators are large flies, especially Syrphidæ, and an oligotropic bee *Andrena parnassiæ* Ckll. A fly by landing in the middle of a flower in the first stage becomes dusted with pollen on the lower side of its body, and afterwards brings the same part of its body in contact with the receptive stigma when visiting a flower in the second stage. *Andrena parnassiæ* the bee specially adapted to *Parnassia Caroliniana* (6) always alights on the middle of the flower and bends the front part of its body (head and thorax) down on one side of the ovary, and the abdomen on the other side, thereby collecting pollen and nectar in the staminate stage, and nectar alone in the pistillate stage.

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6. S. Graenicher. The Relations of the Andrenine Bees to the Entomophilous Flora of Milwaukee County. Trans. Wis. Acad., XV, Part I, pp. 94-95.

Of the 26 visitors enumerated in the foregoing list, 18 or 69% are flies. For *Parnassia palustris* we find the following records (7): H. Mueller and P. Knuth observed 75% flies in Germany among 28 visitors; H. Mueller 73% in the Alps among 59 visitors; Alfken and Leege 63% on the Island of Juist among 19 visitors; Burkill 70% on the eastern coast of Scotland among 23 visitors, and MacLeod 80% in the Pyrenees among 10 visitors. The average for *P. palustris* obtained from these figures amounts to 72%, and it is interesting to note that our *P. Caroliniana* with 69% of flies agrees rather closely with the first named species. The difference in the development of the staminodia in the two considered species does not seem to be of any influence on the visitors if we are entitled to draw conclusions from the number of species or the percentage of flies, but after all there might be a difference in the number of individuals attracted to the flowers.

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7. Cited by Knuth in Handbuch der Bluetenbiologie, II, pp. 458-459.

THE CHEMICAL NATURE OF SOME INSECT SECRETIONS.

BY A. L. MELANDER AND C. T. BRUES.

In this paper we have attempted to give in addition to some original observations, a brief resumé of what is definitely known regarding the general chemistry of the odors of insects and myriapods.

Most of the odorous secretions of insects are the products of highly specialized glands which derive from the blood the foundation for their work. An exception to this, however, is seen in the fat occurring associated with the chitinous skeleton of insects. Of the glandular secretions one may define two categories: those used by the insect directly in its own metabolism, and those of more indirect use as an odorous character and developed to suit peculiar conditions of environment or habits. As the first group includes products found elsewhere throughout the animal kingdom, *e. g.*, the salivary, digestive, and excretory fluids, all secreted by portions of the alimentary tract, we shall pass them by to consider those substances more or less peculiar to insects themselves. These products are of two kinds; defensive, malodorous, highly volatile liquids developed principally to repel predaceous enemies; and alluring, sweet-scented or sweet-tasting fluids used to attract the two sexes of a species or the individuals of a community, or even to insure protection by other species as is the case with many myrmecophilous insects.

We are not aware that anyone has ever attempted to classify insect odors, but Kerner and Oliver ('95) p. 199, have divided the odors of flowers into the following groups: indoloid, aminoid, paraffinoid, benzoloid and terpenoid. As other scents seem to be developed in insects and some to be lacking, this classification is not wholly suited to our purpose. Accordingly, we have used the following outline in the absence of a more satisfactory one. It includes six rather heterogeneous groups: Ethereal and Benzoloid, Indoloid, Isonitrile, Vegetable extracts, Acid, Alkaline.

ETHEREAL AND BENZOLOID.

The European bugs of the genus *Pyrrhocoris* secrete a sweet smelling and pleasant tasting etheral liquid, according to Mayer ('74). The Texan ant, *Camponotus maculatus sansabeanus,* has a marked scent resembling a combination of butyric and valerianic ethers. This we have treated more fully in the sequel, likewise the odor of *Forelius fœtidus.* The odor of the latter, as well as that of many members of the ant subfamily Dolichoderinæ, is very similar to that of rancid cocoanuts. The Harlequin bug has an odor resembling essence of *Gaultheria* or wintergreen. Many Coreidæ, notably the Squash-bug (*Anasa tristis*) possess a very characteristic odor closely resembling that of isoamylacetic ether, while the whole family Pentatomidæ have a weaker disagreeable and probably nearly related ethereal smell. Other bugs possess rather agreeable odors. The giant waterbug (*Belostoma*) gives rise to a pear or banna-like smell according to Locy. *Syromastes* also resembles a fine bergamot pear (Siebold, '48).

The water bettles belonging to the genus *Dineutes* possess the characteristic odor of apple skins, while certain Cicindelidæ are suggestive of hyacinths. The following Lepidoptera have also been described by Packard as being pleasantly odorous ('98): *Pontia napi* yields a scent like citrons, *Callidryas* gives the odor of musk, and *Dircenna* is suggestive of vanilla. Many Cerambycidæ are strongly odorous, for example the European *Aromia moschata* has a powerful smell of musk, while the closely related American *Callichroma plicatum* has a strong honey-like smell, as we have often observed, a fact first mentioned by Wheeler ('90a). The characteristic odor of the Scarabæid beetle *Osmoderma* is evidently of similar composition.

The osmateria of some Papilio larvæ secrete an etheral melon-like fluid, although this scent is usually concealed by stronger disagreeable ones. The leaf beetle, *Lina populi,* produces a secretion with an odor of oil of bitter almonds (dinitrobenzene) (Claus, '61). Candèze has suggested the presence of free hydrocyanic acid in this secretion. The large fly, *Cœnomyia ferruginea,* has a very permanent and strong odor which has been compared by Wheeler ('90a) to the juice of a species of Hypericum.

INDOLOID.

Under this grouping we find a number of insects with a fecal odor, varying greatly in intensity and modification. Of the half a dozen species belonging to the Neuropterous genus Chrysopa with which we are familiar in nature, all possess the odor of human excrement to an excessive degree. A similar odor occurs in the neotropical group of the foraging or driver ants, Eciton. We have treated in detail with the secretions of the Texan species in the second part of this paper.

ISONITRILES.

Both sexes of the large Tarantula-hawk (*Pepsis spp.*) produce a distinct isonitrile odor when first captured. This is quite noticeable, although often modified by the scent of the honey that they have eaten.

The nasutes of an African species of Ptyotermes eject a pungent stream from the head, the nature of which is thus treated by Cook ('90): "The fluid is clear and watery and does not stain the hands. A smarting sensation in the eyes and nose is also distinctly appreciable. The odor is even more disagreeably pungent and penetrating than that of Spirotreptus [a myriapod mentioned below] and has an almost nauseating quality which pervades the nests and galleries of the species and can readily be detected in houses attacked by this termite [isonitriles]. Like the secretion of Polyzonium [another myriapod referred to below] the liquid becomes sticky on exposure to the air, and the insect enemies upon which it is squirted have their antennæ stuck to their bodies and are otherwise disabled."

VEGETABLE EXTRACTS, ETC.

Large numbers of phytophagous insects acquire odors or tastes derived from their food plants, but these hardly come in line with the present discussion.

Many of the Darkling beetles, and especially those belonging to the genus *Eleodes* secrete from anal glands a fluid of an intensely disagreeable odor, which some of the species can forcibly eject for a distance of ten centimeters or more. The liquid stains the skin brown, besides having a very penetrating odor and thus resembles the secretion of *Spirobolus* (see special part). According to Williston ('84) it is soluble in water, alcohol and ether, has an acid reaction, and can be esterified to an agreeably smelling ether by means of alcohol and sulphuric acid. He suggests from this the presence of organic acids other than formic or acetic, which latter he could not detect. Our commonest species, when extracted with ether furnishes an extremely malodorous compound, suggesting extract of *Taraxicum* or opium.

The exuded blood of many Coccinellidæ has an opium-like odor (Packard '98). The species of the ant genus *Cremastogaster*, squirt from their anus a white liquid which recalls the juice characteristic of the shelf-fungi. This odor is much more intense in another ant, *Pachycondla* (*v.* special portion).

The myriapod "*Petaserpes rosalbus* secretes a considerable quantity of a milky substance which has the perfume of gum camphor." (Cope '70) (see also Banks, Science, '00, p. 649) Cook ('90) noted camphor also in *Polyzonium,* a closely related form. These seem to be the only recorded occurrences of camphor in the animal kingdom, but in the absence of chemical evidence must of course remain doubtful. The occurrence of cantharidine in members of the Meloidæ may be mentioned in this connection.

MISCELLANEOUS.

Finally, the assertion that free iodine in present is the gaseous secretion of the Paussid Beetle, *Cerapterus quadrimaculatus* must be noticed. (Loman '87). The close similarity between the purely organic secretion of the Spirobolus described in the sequel and the physical characteristics of free iodine in solution cause us to doubt Loman's observation.

ACID.

A small leaf beetle (*Notodonta*) is stated to secrete hydrochloric acid. (Denham '88). Another leaf beetle, (*Lina*) supposedly secretes Hydrocaynic acid according to Candèze ('74). It has long been known that ants produce formic acid in great quantity, while this acid is probably present in the poison of all wasps (Forel '78). The relative amount in various species of ants will be tabulated in the special part of this paper. Butyric acid as well as formic occurs in nearly all the Carabidæ associated with other substances. The whip scorpion (*Thelyphonus*) secretes acetic acid (Marx. '86) in such quantity that a stream is ejected from each side of the body which fact has earned its Mexican name of "viñagron". According to Claus ('87) the myriapod *Fontaria* secretes a fluid which contains free hydrocyanic acid. Cope ('70) and Wheeler ('90) have both demonstrated that the allied *Polydesmus virginiensis* secretes free hydrocyanic acid.

ALKALINE.

The only recorded case of a strong alkali being found in the animal kingdom is in *Dicranura,* and some other moths, which produce potassium hydroxide at the last moult in order to soften the silk of the cocoon (Latter '92 and '95). Strangely enough the larva of this same insect produces formic acid in quantity (Meldola '92).

The carrion beetles of the family Silphidæ emit from the mouth and anus a fetid liquid with an ammoniacal odor (Packard '98 p. 375) as we have frequently noticed. This is probably derived from the decomposition of its food and is not a glandular product at all.

SPECIAL PART.

Experiments with Myriapods.

For many years the repugnatorial secretion of the Julidæ has been referred to by various writers, although even yet nothing definite is known of its chemical composition. As long ago as 1870 Prof. E. D. Cope ('70) remarked that "the species of *Spirobolus* and *Julus* discharge a yellowish juice having much the smell of aqua regia and a very acrid taste. The *Spirostrephon lactarius* exudes from a series of lateral pores a fluid which has in its odor a close resemblance to creasote." Wheeler ('90) has "frequently seen our common Julus,* when irritated, emit from its repugnatory glands a brown liquid with a pungent odor not unlike bromine." More recently Cook ('00) has treated in greater detail the question of this secretion.

We quote the following from his observations: "When the liquid comes in contact with the skin a yellowish green stain results, which gradually deepens to a dull purple. * * * The alcohol in which these large diplopods are collected takes on similar colors, yellowish green at first, changing to a very deep purplish red, and has a characteristic disagreeable odor different from that of the living animal, but still in some respects suggesting it. This odor Loew considered similar to that of pyridine. * * * Direct exposure to the light and heat of the sun is also speedily fatal to many diplopoda, the heavily armored Spiroboli are often quite dead after ten or fifteen minutes' exposure. That this susceptibility may prove to be the result of some chemical change or dissociation of the stored repugnatorial fluid is apparently indicated by the fact that animals killed by exposure to the sun do not stain the alcohol as described above, the repugnatorial fluid having oozed out and having been evaporated from the surface of the segments. This suggests a further possibility that the material elaborated in the repugnatorial glands may not attain its final and effective composition until directly or indirectly acted upon by the air."

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* Probably identical with the species of *Spirobolus* here considered.

Our experiments were carried on with about a hundred large specimens of *Spirobolus marginatus* Say. Although largely negative we deem our results of interest, as they seem to be somewhat at variance with the conclusions arrived at by Dr. Cook.

The animals were forced to secrete by roughly shaking them in tepid water. By this means the *Spirobolus* were not injured and could be reserved for a future experiment. After some ten extractions they were unable to elaborate any further secretion, although they were carefully fed in the meantime. The water thus acquired a strong pungent odor and a dull yellowish color, as the secretion is very readily soluble in water. On heating for a moment to about 80 or 90 degrees the yellow completely changes to brown and the odor is greatly modified, losing its pungency. The addition of a small amount of alcohol effects a similar change, and even on exposure to the air for a few hours the water-solution undergoes the same color-changes. If the solution be shaken with ether, chloroform, benzene, or carbon disulphide while it is still in the yellow stage, the secretion readily passes into the added solvent, tinging it intense yellow, and leaving the water colorless. The extraction by ether may even be hastened by the addition of some salt.

It readily diffuses into the lower alcohols, while less rapidly into the higher, *e. g.*, amyl alcohol acquires the same tint as the water-layer above only after twenty-four hours, and never absorbs more of the secretion than the water does. After decomposition has takn place (*i. e.*, when the liquid is in the brown stage), a separation of the secretion cannot be effected by any of the named solvents.

When an ether extraction is carefully evaporated, the secretion can be obtained in its original concentration. It is then extremely volatile and pungent, irritating the eyes causing them to lachrymate, much like bromine; it has an atrociously acrid taste; stains paper, cloth, and the skin a deep yellow, which passes to a permanent brown; it is neither acid nor alkaline to indicators; it gives no reaction with $PtCl_4$, $FeCl_3$, nor concentrated HNO_3. When saponified with KOH the color changes to the greenish red noticed in the decomposed aqueous extract, while the odor disappears. The original odor can be brought back by the addition of HCl, although faintly at times. When dried in a sulphuric acid desiccator on a watch glass the secretion is absorbed by the acid, thus suggesting in connection with its peculiar odor, a nitrile; but so far all tests for nitrogen and sulphur have proved negative. If the secretion be placed in a nearly closed pipette and kept for an extended time at an exhaustion of about 300 mm., a number of small metallic, bluish-purple, spurred and acidulated scales and needles appear in the upper bulb of the tube. These lamellæ appear pink by transmitted light. Although by their luster and volatile character they suggest iodine, they give no test for this element, and are probably a polymerisation product, as they increase in number with time, even when kept at the ordinary pressure.

Unfortunately, although our *Spirobolus* were very active at first—on one occasion a large specimen ejected a decided stream a distance of ten inches—they soon showed signs of weakening, and after about ten extraction, which gradually diminished in amount during the four months of experiment, their glands refused to reproduce their secretion, although the animals seemed otherwise in good condition, and we were forced to discontinue the interesting study.

Although Loew suggested pyridine it was with the understanding that this odor might have come from the German alcohol used as the preservative. This must obviously be its source, as *Spirobolus* has quite a different odor. The facts brought forth by Dr. Cook as to the action of the air we have duplicated during our tests, and these can all be explained upon the idea of saponification. It is not the final composition that is effective as the repelling agent, as he has suggested, but the condition that obtains just before decomposition. The unstable nature of the secretion gives it great reducing power, as can be shown with alkalinated silver iodide. Its staining effects recall the secretions of Brachynus, Platynus, and their related forms among the beetles, which insects Julus greatly resembles in smell, but in addition to the staining principle these Carabidæ produce formic and butyric acids, so the secretions cannot be identical.

Experiments with Ants.

A. The relative Amount of Formic Acid present in different Species.

It has long been known that certain species of ants, *e. g.*, Formica and Lasius, secrete a considerable amount of free formic acid. This is stored up in the sac which contains the acid part of the stinging fluid in those species of Ants which have well-developed stings, while in those devoid of stings it is retained in a special sac in the posterior part of the abdomen. The following experiments were conducted with a view towards determining what amount of formic acid is present in different forms, and if the amount is constant for each species.

The ant selected for preliminary experiments was *Formica fusca,* var. *gnava* Buck., as it was evident from its strongly acid odor that formic acid was here present.

A counted number of the ants were collected in weak ethyl alcohol, and then subjected to distillation in a small flask with steam. After the distillate had ceased to show an acid reaction, a few cubic centimeters of dilute sulphuric acid were added to the flask and the distillation continued, in order to ascertain if any of the formic acid in the ants had combined with any small particles of calcareous earth that might have been present adhering to their bodies or in the alimentary tract. After removing any trace of sulphuric acid from the second distillate by means of barium chloride, it was tested for formic acid by the method given below, but not even an acid reaction could be obtained.

The first distillate was then titrated with semi-normal potassium hydroxide and its acidity noted. The solution of potassium formate thus obtained was then heated for several hours at 100 C. on a water bath with an excess of mercuric chloride solution and the amount of reduced calomel weighed. This method with mercuric chloride was found, however, to be very unsatisfactorv, as it gave widely divergent results with distillates whose titration determinations were very nearly equal. The poor results thus obtained were probably due to the presence of organic matter other than formic acid, and perhaps in some cases to an incomplete reaction of the alkaline formate. But as no other acid, e. g., acetic, butyric, hydrochloric, etc., could be detected, titration with semi-normal potassium hydroxide was selected as the most reliable method.

The following table, compiled from a large series of determinations, shows the amount of formic acid in a number of species of Formicidæ. As the agreement is in most cases so close, only a few determinations are given for each species, besides several widely divergent ones that seem worthy of notice.

TABLE I.

Weight in Grams of Formic Acid Present in Ants of Different Species.

	Mercuric chloride.	Titration.	Titration.	Titration.
Formica fusca. var.gnava Bkly.				
worker.	.0004960	.0006342	*.0001854	§.0003986
female.		.0003285		
Camponotus maculatus, var sansabeanus Bkly.				
worker major.	.0005443	.002150	.002230	
worker minor.		.000448		
Camponotus fumidus Roger.				
worker major.	.0008401	.001725	.001533	.001744
worker minor.		.000414	.000418	*.000158 §.000368
Componotus americanus. Mayr.	.00009766	.0002668	.0002390	
Cremastogaster lineolata, var.clara Mayr.	trace	trace		
Pachycondyla harpax.		.000208		
Forelius foetidus. Bkly.	none	none		
Atta fervens, Say.		none		
Pheidole several spp.		none		
Pogonomyrmex barbatus. Sm.		none		
Eciton spp.		none		

* These ants were kept for a considerable time in a cloth bag in the laboratory.

§ Collected in very dry weather.

As these data are wholly independent of the size of the ants they give a poor idea of the relation between the amount of acid and the weight of the ant. This is obviated in the following table, which is derived from the one given above by dividing the actual amount per ant by the weight of the ant itself in grams.

TABLE II.

Table Showing Relative Amount of Formic Acid Per Weight of Ant in Various Species.

Formica fusca		
worker	.005	.1268
female	.030	.0109
Camponotus sansabeanus		
worker major	.041	.0534
worker minor	.009	0506
Camponotus fumidus		
worker major	.020	.0814
worker minor	.005	.0832
Camponotus americanus	.005	.0478
Pachycondyla harpax	.013	.0160

It is seen that Formica heads the list, containing more than twice as much acid relative to its size as the species of *Camponotus* examined and which follow it in the list. We believe, however, that when *Myrmecocystus* is tested in a similar way, it will show a still greater amount, as its acid odor is much more intense.

It should be noticed here that the females and males never gave any test for acid, except in a single form (female of *Formica*); also that as a rule only the species of genera which are not provided with stings showed any considerable amount of acid other than that which could be attributed to acid in the alimentary tract or in the small acid sting gland. *Cremastogaster* may prove to be an exception, but in this case most likely some other acid is present. Forelius is a stingless ant and we should expect to find it provided with acid, but it is neutral, probably because of the substitution of a peculiar ethereal secretion to take the place of the acid (see below). Pachycondyla, one of the Ponerinæ, although provided with a powerful sting, shows the presence of a considerable amount of acid. The males of no species secrete any acid, and as a general rule the females scarcely ever more than a trace.

THE DISTINCTIVE ODORS OF SOME SPECIES.

No one who has ever collected ants extensively can have failed to notice the very strong and distinctive odors possessed by many species. Other species also, which are not particularly odorous, yield peculiar scents when carefully examined.

I. ECITON.

All the species of this genus of ants which we have examined (viz: *E. cœcum, E. schmitti, E. sumicrasti, E. opacithorax, E. californicum, E. pilsoum*) possess a strikingly similar and very disagreeable odor. This odor, or one barely distinguishable from it, is secreted in even a more marked degree by species of the Neuropterous genus *Chrysopa*. In the latter insect it was long ago described by Say ('59) as closely resembling human feces.

The specimens of *Eciton* examined were subjected to distillation with steam and the first few cubic centimeters of the distillate collected. In this was found almost all the volatile odorous substance. When isolated in this manner the fecal or indoloid odor is even more pronounced than when the worker ants are crushed between the fingers. As the odor strongly suggested indol or some of its numerous disagreeably smelling derivatives, tests were made for indol by crushing some of the ants on a piece of plantinum foil with concentrated nitric acid, then evaporating to a yellow residue which turned to a yellow-brown upon the addition of a small quantity of potassium hydroxide solution. The color seems to be produced not by indol, however, but rather by the burnt chitin or animal fat, as other insects which did not have an indoloid odor gave the same result. The very delicate and characteristic test with strong hydrochloric acid and a pine splinter was also tried, but with negative results, as no red or purple color was developed. As it is not an indol and yet has a fecal odor it would seem that it must contain a leucin. Its solubility also indicates the presence of this substance since it is readily extracted from the ants by water or ether, but not at all by absolute alcohol. When an ethereal extraction of the ants is rapidly evaporated under reduced pressure a few pearly fat globules are obtained, which are in part soluble in water, while the addition of alcohol causes a globule to separate for a few moments (leucin and fat?), later to disappear. After evaporation of the alcohol from this and freezing the residue, some crystals very much resembling leucin could be observed under the microscope, although contaminated greatly and rendered somewhat obscure by the large amount of fat present in the mixture. These crystals were very distinct when the flask was cold, but as it became warmed up to the room temperature they melted or dissolved in the fat.

The original ether extraction is neither acid nor alkaline to indicators, and on saponification with potassium hydroxide gives no odor of amonia, but a smell resembling œnanthol, which most probably arises from the fat and not from the odorous principle. Thus although there is no positive evidence that the substance present in Eciton is actually leucin, nothing seems to oppose such a conclusion.

That the Eciton odor has considerable biological significance is very probable. These ants are totally blind, and migratory in their habits, so that they must depend almost entirely upon a sense of smell to follow one another about. Thus it can easily be seen how much a strong odor might be developed through the action of natural selection, from the small trace of leucin that is usually present in insect feces. (Concerning the normal presence of leucin in the alimentary tract of insects see Plateau ('73).)

II. FORELIUS FŒTIDUS.

The Texan species of this monotypical genus, like the species of Tapinoma and a few other closely related ants, has a very strong and peculiar odor which has been very aptly described by Buckley ('66), and later by Forel, as closely resembling "rotten cocoanuts."

These ants are very small and cannot be conveniently picked up by the forceps, but may be collected in almost any number by placing pieces of filter paper soaked in sugar solution near the nests. They collect on the paper to feed upon the sugar and may be easily shaken into a bottle.

When distilled with steam the odor passes over and remains dissolved in the aqueous distillate. Thus freed it retains the very evident odor of rancid cocoanuts. By saponification with potassium hydroxide solution it loses all odor, but on adding dilute sulphuric acid to excess an odor closely resembling that of *fresh* cocoanuts is developed. From this it is quite evident that the odorous principle is an ether of some sort. Attempts to identify the free acid were not successful; its odor is too pleasant to associate with any of the lower straight chain fatty acids, but may possibly be due to a forked chain one, or to a higher fatty acid. It does not seem likely that it is an aromatic acid.

III. CAMPONOTUS MACULATUS, VAR SANSABEANUS.

All the castes of this ant, and more especially the males, possess a strong, sweet pelargonic smell which very closely resembles a bouquet of valerianic and butyric ethers. The odor is at first concealed by the stronger smell of formic acid, but is very pronounced when an aqueous distillate from the ants has been neutralized with an alkali. This physiological peculiarity readily serves to separate it from *Camponotus fumidus,* an allied form which often greatly resembles it in the worker major caste, for the latter species is wholly devoid of the geranium-like odor.*

IV. FORMICA FUSCA VAR. GNAVA.

This ant, too, has its own distinctive odor, which can be readily recognized after the aqueous distillate has been neutralized with an alkali. The odor is exactly that of the mixture of sodium palmitate and oleate, which give to ordinary soap its odor.

V. CREMASTOGASTER LINEOLATA, VAR. CLARA.

The odor associated with this ant is one of the most unpleasant that we have encountered in the course of our work. At first the fresh ants have quite a strong odor strikingly similar to chlorine.

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* We are thus enabled to repeat on a small scale in the animal kingdom, the physiological separation of species by olfactory means, a thing which has often been effected by botanists with plant species, more notably among the roses (cf. Kerner and Oliver, '95).

This soon passes away, leaving an after odor suggestive of the large shelf fungus (*Polyporus.*)

VI. PACHYCONDYLA HARPAX.

Here the odor is hardly distinguishable from the fungoid smell of *Cremastogaster,* although it is not evident until the ants have been crushed.

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OBSERVATION ON A PIED RAT.

BY HENRY L. WARD.

Somewhat over a year ago I made the following notes which although very fragmentary may have some interest to those giving attention to animal psychology. My intention at the time was to carry these observations farther and to that purpose I made some apparatus to test the rats' appreciation, if any, of the relationships between less obvious causes and effects, but a suddenly evinced fondness of the rat to nest in the mechanism of the piano created a domestic condition unfavorable to farther scientific inquiry and so the animal was given away and the experiments abruptly terminated.

NOTES MADE MARCH 12, 1905.

There lately came into my possession a tame pied rat; with head, neck and part of back dark reddish brown and the rest of the body and extremities white; eyes black. It is said, upon what authority I do not know, to be a Japanese breed. Its general appearance would indicate that it is a variety of the Black Rat, *Mus rattus*. When first taken to my home it had been in close confinement for some time and was very tame. It was put into a wire bird cage having a lift door sliding upon the vertical bars at either side; the door itself being made of similar vertical bars connected at the top and bottom by a strip of metal. For a week the rat has been kept in this cage with frequent taking out for handling by my children. Occasionally it has been allowed the liberty of the rooms for some hours and yesterday evening secreted itself and was not returned to the cage nor discovered until late this afternoon. It was noticed that this unusual amount of liberty had resulted in a considerable degree of wildness. The rat was not timid but did not wish to be confined. It was caught and returned to its cage where it drank, ate and cleaned its fur. After about a half hour's confinement I observed it turn its head so that its horizontal plane was vertical, seize one of the bars of the door in its teeth, raise it about an inch, drop it and place its nose at the bottom. It repeated this operation two or three times, then inserted its paws under the door when raised, let lose with its teeth, placed its nose under the bottom, raised the gate and came out.

It was allowed a few minutes liberty and was again placed in the cage at 5:44 when it spent a few moments cleaning its coat. then seized one of the bars as before except that it took hold of a bar on the side of the gate at which its body was. Upon lifting the gate the immovable wires interfered with its placing its paws under the gate. It released its hold, seized one of the bars near the center, raised the gate, apparently slipping and letting it fall, an action which was repeated two or three times before it raised it again, placed both feet under it, inserted its nose in the opening and escaped at 5:45.

After a few minutes I again placed it in the cage and it began eating a cube of sugar. I busied myself in an adjoining room and after some minutes heard the rat's teeth on the wire and within ten seconds saw it on the floor. Shortly afterwards I returned it to the cage placing the lump of sugar upon the floor outside and opened my watch. The rat turned around, seized one of the middle wires and as above described made its exit and seized the lump of sugar in 8 seconds.

The family returning, I questioned them as to whether they had known of the rat's previously escaping from the cage and was assured that it had not done so. To show them what it could do I confined it and we waited for a few moments while it drank and ate, then it turned its attention to the gate but instead of turning its head sideways and seizing one of the vertical bars as I expected it would do, it grasped the lower horizontal metal strip connecting them, raised the gate at one endeavor and came out. The children put it back a number of times and on each occasion it adopted this latter, more convenient and more certain method of accomplishing its object.

The sudden discovery of a means of release and the rapid improvement on this both in time and details seem worthy of note.

LIST OF LEPIDOPTERA OCCURRING IN MILWAUKEE COUNTY.

BY VALENTINE FERNEKES.

The present list is based on one previously published in the Bulletin of this society in 1900 by F. Rauterberg. Changes in nomenclature during the past few years have rendered the old list obsolete in form, and further studies have revealed the necessity of a considerable number of changes and emendations as well as the addition of numerous species not hitherto listed from this locality.

The nomenclature adopted by Dyar in his recent catalogue has been strictly followed with one or two exceptions, and the numbers there used are also added for convenience in reference.

SUPERFAMILY PAPILIONOIDEA.

PAPILIONIDÆ.

IPHIDICLES Hbn.

5 *ajax* Linn. Rare.

PAPILIO Linn.

11 *glaucus* Linn. Rare.
11*a* *turnus* Linn. Rare.
13 *troilus* Linn. 1 sp.
14 *thoas* Linn. Very Rare.
22 *polyxenes* Fabr. Very Common.

PIERIDÆ.

PONTIA Fabr.

37 *protodice* Bsdv. LeC. Very Common.
38*g* *virginiensis* Edw. Very Common.
40 *rapæ* Linn. Very Common.
40*a* *novangliæ* Scud. Rare.
40*b* *immaculata* S. & A. Rare.

NATHALIS Bsdv.

41 *iole* Bsdv. Very Rare.

ZERENE Hbn.

61 *cæsonia* Stoll. Common.
61*a* *rosa* McNeil. Rare.

EURYMUS Swain.

65 *eurytheme* Bsdv. Common.
65*a* *ariadne* Edw. Rare.
65*b* *eriphyle* Edw. Very Rare.
66 *philodice* Gdt. Very Common.

PYRISITA Butl.

81 *mexicana* Bsdv. 1 sp.

EUREMA Hbn.

85 *euterpe* Méné. Common.

NYMPHALIDÆ.

EUPTOIETA Dbld.

92 *claudia* Cram. Rare.

SPEYERIA Scudd.

95 *idalia* Dru. Rare.

ARGYNNIS Fabr.

99 *cybele* Fabr. Common.
100 *aphrodite* Fabr. Common.
100*a* *alcestis* Edw. Common.

BRENTHIS Hbn.

131 *myrina* Cram. Common.
141 *bellona* Fabr. Common.

EUPHYDRYAS Scud.

146 *phaeton* Dru. Very Rare.

CHARIDRYAS Scud.

185 *nycteis* D. & H. Common.

PHYCIODES Hbn.

189 *tharos* Drn. Common.

POLYGONIA Hbn.

205 *interrogationis* Fabr. Common.
205*a* *umbrosa.* Lintn. Common.
206 *comma* Harr. Common.
206*a* *dryas* Edw. Common.
214 *progne* Cram. Common.

EUGONIA Hbn.

215 *j-album* Bsdv. Rare.

EUVANESSA Scud.

217 *antiopa* Linn. Very Common.

AGLAIS Dalm.

218 *milberti* Gdt. Very Rare.

VANESSA Fabr.

219 *atalanta* Linn. Very Common.
220 *huntera* Fabr. Very Common.
221 *cardui* Linn. Very Common.

JUNONIA Hbn.

223 *cœnia* Hbn. Rare.

BASILARCHIA Scud.

236 *astyanax* Fab. Common.
237 *arthemis* Drn. Common.
237*a* *proserpina* Edw. Common.
239 *archippus* Cram. Common.
240 *floridensis* Strck. Common.

AGAPETIDÆ.

CERCYONIS Spey.

258 *alope* Fabr. Common.
258*a* *texana* Edw. Very Rare.
258*c* *nephele* Kirby. Rare.

CŒNONYMPHA Hbn.

285 *haydenii* Edw. Rare.

SATYRODES Scud.

288 *canthus* Linn. Common.

CISSIA Dbld.

299 *eurytus* Fabr. Very Common.

LYMNADIDÆ.

ANOSIA Hbn.

308 *plexippus* Linn. Very Common.
309 *berenice* Cram. Rare.

LIBYTHEIDÆ.

HYPATUS Hbn.

311 *bachmani* Kirt. Very Rare.
312 *carinenta* Cram. Very Rare.

RIODINIDÆ.

CALEPHELIS G. & R.

321 *borealis* G. & R. Rare.

LYCÆNIDÆ.

EUPSYCHE Scud.

330 *m-album* Bd. & LeC. Very Rare.

THECLA Fabr.

339 *acadica* Edw. Common.
347 *calanus* Hbn. Rare.

CHRYSOPHANUS Hbn.

393 *thoe* Bsdv. Very Common.

HEODES Dalm.

399 *hypophleas* Bsd. Very Common.

CYANIRIS Dalm.

440 *ladon* Cram. Common.
440*a* *lucia* Kirby. Common.
440*c* *violacea* Edw. Common.
440*f* *neglecta* Edw. Common.

EVERES Hbn.

442 *comyntas* Gdt. Common.

HEMIARGUS Hbn.

447 *hanno* Stoll. Very Rare.

LEPTOTES Scud.

452 *theonus* Luc. Rare.

HESPERIIDÆ.

AMBLYSCIRTES Scud.

463 *samoset* Scud. Common.

ANCYLOXYPHA Feld.

472 *numitor* Fabr. Common.

OARISMA Scud.

480 *powescheik* Parker. Common.

ATRYTONE Scud.

483 *zabulon* Bd. & Lec. Very Common.
484 *hobomok* Harr. Common.
484*a* *pocahontas* Scud. Common.

ERYNNIS Schrank.

487*e* *manitoba* Scud. Rare.

ANTHOMASTER.

504 *leonardus* Harr. Rare.

THYMELICUS Hbn.

519*a* *egeremet* Scud. Rare.
520 *mystic* Scud. Rare.
523 *cernes* Bd. & Lec. Common.

POLITES Scud.

526 *peckius* Kirby. Common.

EUPHYES Scud.

529 *vestris* Bd. Common.

LIMOCHROES Scud.

557 *manataaqua* Scud. Common.

EPARGYREUS Hbn.

584 *tityrus* Fabr. Common.

ACHLARUS.

591 *lycidas* S. & A. Common.

THORYBES Scud.

600 *mexicana* H. & S. Rare.
601 *pylades* Scud. Common.

THANAOS Bsdo.

618 *icelus* Lint. Rare.

HESPERIA Fabr.

642 *tessellata* Scud. Rare.

SUPERFAMILY SPHINGOIDEA.

SPHINGIDÆ.

HEMARIS Dalm.

653 *diffinis* Bsdv. Common.
653*a* *axillaris* G. & R. Common.
653*b* *tenuis* Grt. Common.
656 *thysbe* Fabr. Common.

DEILEPHILA Ochs.

670 *gallii* Rott. Rare.
671 *lineata* Fabr. Very Common.

ARGEUS Hbn.

674 *labruscæ* Linn. Very Rare.

PHOLUS Hbn.

678 *pandorus* Hbn. Rare.
679 *achemon* Dru. Common.

AMPELOPHAGA Brem & Grey.

681 *chœrilus* Cram. Very Rare.
6o2 *myron* Cram. Common.

PHLEGETHONTIUS Hbn.

696 *quinquemaculata* Haw. Common.
697 *sexta* Johans.
699*a* *cingulata* Fabr.

SPHINX Linn.

700 *kalmiæ* S. & A. Very Rare.
701 *drupiferarum* S. & A. Rare.
703 *gordius* Stoll. Very Rare.
706 *chersis* Hbn. Common.
706*a* *libocedrus* Hy. Edw.

CERATOMIA Harr.

721 *amyntor* Hbn. Rare.
722 *undulosa* Walk. Common.

MARUMBA Moore.

728 *modesta* Harr. Rare.

SMERINTHUS Satr.

729 *jamaicensis* Dru. Rare.
730 *cerysii* Kirby. Common.
730*b* *ophthalmicus* Bsdv. Rare.

PAONIAS Hbn.
731 *excæcatus* S. & A. Common.
732 *myops* S. & A. Common.

CRESSONIA G. & R.
734 *juglandis* S. & A. Rare.

ARCTONOTUS Bsdv.
735 *lucidus* Bsdv. Rare.

SUPERFAMILY SATURNOIDEA.

SATURNIIDÆ.

PHILOSAMIA Grt.
736 *cynthia* Drn. Very Rare.

SAMIA Hbn.
739 *cecropia* Linn. Common.
740 *gloveri* Strck. Very Rare.

CALLOSAMIA Pack.
744 *promethia*. Drn. Very Common.

AGAPEMA N. & D.
746 *galbina* Clem. Rare.

TROPÆA Hbn.
747 *luna* Linn. Rare.
747*a* *dictynna* Walk. Very Rare

TELEA Hbn.
748 *polyphemus* Cram. Common.

AUTOMERIS Hbn.
753 *io* Farb. Rare.

HEMILEUCA Walk.
757 *maia* Dru. Common.
758 *nevadensis* Strck. Common.

CERATOCAMPIDÆ.

ANISOTA Hbn.
770 *virginiensis* Dru. Rare.
771 *rubicunda* Fabr. Common.

CITHERONIA Hbn.
776 *regalis* Fabr. Rare.

BASILONA Bsdv.
778 *imperialis* Dru. Very Rare.
778*a* *didyma* De B. Very Rare.

SUPERFAMILY BOMBYCOIDEA.

SYNTOMIDÆ.

SCEPSIS Walk.
787 *fulvicollis* Hbn. Common.

LYCOMORPHA Harr.
792 *pholus* Dru. Rare.

CTENUCHA Kirby.
798 *virginica* Charp. Rare.

LITHOSIIDÆ.

CRAMBIDIA Pack.
800 *pallida* Pack. Common.

LEXIS Wall.
806 *bicolor* Grt. Rare.

HYPOPREPIA Hbn.
807 *miniata* Kirby. Rare.
808 *fucosa* Hbn. Common.

CLEMENSIA Pack.
817 *albata* Pack. Rare.

ARCTIIDÆ.

EUBAPHE Hbn.
833 *immaculata* Reak. Very Rare.
834 *aurantiaca* Hbn. Common.
834*d* *quinaria* Grt. Rare.

UTETHEISA Hbn.
836 *bella* Linn. Common.
836*a* *hybrida* Butl. Rare.
837 *ornatrix* Linn. Rare.

HAPLOA Hbn.

840 *lecontei* Bsdv. Common.
840*c* *militaris* Harr. Common.
840*d* *harrisii* Dy. Common.
840*e* *smithii* Dy. Rare.
840*f* *vestalis* Pack. Common.
842 *contigua* Walk. Rare.

ESTIGMENE Hbn.

851 *acræa* Dru. Very Common.
854 *congrua* Walk. 1 sp.

HYPHANTRIA Harr.

855 *cunea* Dru. Common.

ISIA Walk.

859 *isabella* S. & A. Very Common.

PHRAGMATOBIA Steph.

860 *fuliginosa*. Common.

DIACRISIA Hbn.

862 *virginica* Fabr. Very Common.
863 *latipennis* Strck. Rare.

MÆNAS Hbn.

866 *vestalis* Pack. Rare.

APANTESIS Walk.

874 *virgo* Linn. Common.
875 *virguncula* Kirby. Common.
875*a* *otiosa* N. & D. Common.
879*a* *rectilinea* Frch. Common.
880 *anna* Grt. Common.
880*a* *persephone* Grt. Common.
882 *arge* Dru. Common.
894 *nais* Dru. Common.
895 *vittata* Fabr. Very Rare.
895*b* *phalerata* Harr. Common.

AMMALO Walk.

905 *tenera* Hbn. Common.

EUCHÆTIAS Lynn.

911 *oregonensis* Strch. Very Rare.

HALISIDOTA Hbn.

919 *tesselaris* S. & A. Common.
922 *maculata* Harr. Common.
922*b* *agassizii* Pack. Rare.
923 *caryæ* Harr. Rare.

AGARISTIDÆ.

ALYPIA Hbn.

949 *octomaculata* Hbn. Very Common.

COPIDRYAS Grt.

956 *gloveri* G. & R. Rare.

NOCTUIDÆ.

SUBFAMILY NOCTUINÆ.

PANTHEA.

960 *acronyctoides* Walk. Very Rare.

CHARADRA Walk.

964 *deridens* Gn. Rare.

RAPHIA Hbn.

968 *frater* Grt. Common.
970 *abrupta* Grt. Common.

APATELA Hbn.

972 *americana* Harr. Common.
975 *dactylina* Grt. Common.
983 *populi* Ril. Common.
984 *lepusculina* Gn. Common.
985 *innotata* Gn. Rare.
989 *betulæ* Riley. Common.
990 *morula* Grt. Common.
991 *interrupta* Gn. Common.
993 *lobeliæ* Gn. Common.
1002 *clarescens* Gn. 1 sp.
1003 *hamamelis* Gn. Common.
1004 *superans* Gn. Rare.
1005 *lithospila* Grt. Rare.
1009 *fragilis* Gn. Rare.
1018 *afflicta* Grt. Very Rare.
1026 *brumosa* Gn. Rare.
1028 *retardata* Walk. Common.
1041 *oblinita* S. & A. Common.

ARSILONCHE Led.

1049 *albovenosa* Goeze. Common.

HARRISIMEMNA Grt.

1053 *trisignata* Walk. Very Rare.

MICROCŒLIA Gu.

1054 *dipteroides* Gn. Rare.
1054*a* *obliterata* Grt. Rare.

JASPIDIA Hbn.

1055 *lepidula* Grt. Rare.
1059 *teratophora* H. & S. Rare.

CHYTONIX Grt.

1067 *palliatricula* Gn. Rare.

BAILEYA Grt.

1073 *ophthalmica* Gn. Common.
1075 *doubledayi* Gn. Rare.

CRAMBODES Gu.

1087 *talidiformis* Gn. Common.

BALSA.

1092 *malana* Fitch. Rare.

CARADRINA Ochs.

1109 *miranda* Grt. Common.

PERIGEA Gu.

1117 *vecors* Gn. Rare.
1119 *sutor* Gn. Very Rare.

OLIGIA Hbn.

1138 *versicolor* Grt. Very Rare.
1141 *grata* Hbn. 1 sp.

HADENA Schrank.

1152 *leucoscelis* Grt. Rare.
1158 *modica* Gn. Common.
1166 *mactata* Gn. Rare.
1205 *semicana* Walk. Common.
1205*a* *fractilinea* Grt. Common.
1210 *niveivenosa* Grt. Common.
1211 *stipata* Morr. Rare.
1212 *passer* Gn. Common.
1217 *remissa* Hbn. 1 Sp.
1219 *suffusca* Morr. Rare.
1220 *vultuosa* Grt. Common.
1221 *apamiformis* Gn. 1 Sp.
1224 *finitima* Gn. Rare.
1227 *dubitans* Walk. Common.
1231 *impulsa* Gn. Common.
1232 *devastatrix* Brace. Very Common.
1235 *arctica* Bsdv. Very Common.
1240 *cuculliformis* Grt. Common.
1241 *verbascoides* Gn. Common.
1243 *cariosa* Gn. Rare.
1244 *vulgaris* G. & R. Rare.
1250 *lignicolor* Gn. Common.

MACRONOCTUA Grt.

1255 *onusta* Grt. Common.

POLIA Hbn.

1268 *medialis* Grt. Rare.

HYPPA.

1278 *xylinoides* Gn. Common.

EUPLEXIA Steph.

1288 *lucipara* Linn. 1 sp.

TRACHEA Hbn.

1289 *delicata* Grt. Common.

DIPTERYGIA Steph.

1290 *scabriuscula* Linn. Rare.

ACTINOTIA Hbn.

1291 *ramosula* Gn. Very Rare.

PYROPHILA Hbn.

1295 *pyramidoides* Gn. Very Common.

HELIOTROPHA Led.

1297 *reniformis* Grt. Rare.
1297*a* *atra* Grt. Rare.

PRODENIA Gu.

1300 *ornithogalli* Gn. Common.
1300*a* *eudiopta* Gn. Common.

LAPHYGMA Gu.

1302 *frugiperda* S. & A. Common.
1302*a* *obscura* Riley. Common.

MAGUSA Walk.

1305 *dissidens* Feld. Rare.

HOMOHADENA Grt.

1312 *badistriga* Grt. Rare.

RHYNCHAGROTIS Smith.

1389 *gilvipennis* Grt. Very Rare.
1390 *rufipectus* Morr. Common.
1391 *brunneicollis* Grt. 1 sp.

1393 *anchocelioides* Gn. Common.
1395 *placida* Grt. Common.
1397 *alternata* Grt. Common.

ADELPHAGROTIS Smith.

1415 *prasina* Fabr. Common.

PLATAGROTIS Smith.

1418 *pressa* Grt. Rare.

EUERETAGROTIS Smith.

1422 *sigmoides* Gn. Common.
1423 *perattenta* Grt. Rare.

AGROTIS Ochs.

1451 *badinodes* Grt. Rare.
1454 *ypsilon Rott.* Very Common.

PERIDROMA Hbn.

1462 *occulta* Linn. Rare.
1467 *margaritosa* Haw. Common.
1467*a* *saucia* Hbn. Common.

NOCTUA Linn.

1475 *smithii* Snell. Common.
1476 *normaniana* Grt. Common.
1478 *bicarnea* Gn. Common.
1479 *treatii* Grt. Very Rare.
1481 *c-nigrum.* Very Common.
1484 *phyllophora* Grt. Rare.
1489 *fennica* Tausch. Common.
1490 *plecta* Linn. Common.
1493 *haruspica* Grt. Common.
1496 *clandestina* Harr. Common.
1511 *cynica* Smith. Very Rare.

RHIZAGROTIS Smith.

1532 *apicalis* Grt. Rare.

FELTIA Walk.

1538 *subgothica* Haw. Common.
1540 *jaculifera* Gn. Common.
1540*a* *herilis* Grt. Common.
1544 *gladiaria* Morr. Common.
1545 *venerabilis* Walk. Common.
1549 *volubilis* Harvey. Common.
1550 *annexa* Treitsch. Common.

POROSAGROTIS Smith.

1552 *vetusta* Walk. Common.
1553 *catenula* Grt. Common.
1556 *mimallonis* Grt. Common.
1558 *tripars* Walk. Common.
1559 *rileyana* Morr. Common.

PARAGROTIS Pratt.

1620 *scandens* Riley. Rare.
1623 *detersa* Walk. Rare.
1649 *messoria* Harr. Common.
1655 *fulda* Smith. 1 sp.
1707*a* *verticalis* Grt. Common.
1711 *tesselata* Harr. Common.
1737 *redimicula* Morr. Common.
1735 *lucindus* Bsdv. Rare.

FOCILLA.

sytis Gn. 1 sp. New to U. S.

ANYTUS Grt.

1753 *privatus* Walk. Common.

MAMESTRA Ochs.

1771 *discalis* Grt. Rare.
1773 *nimbosa* Gn. Rare.
1774 *imbrifera* Gn. Rare.
1781 *meditata* Grt. Rare.
1782 *lustralis* Grt. Common.
1783 *detracta* Walk. Rare.
1796 *subjuncta* G. & R. 1 sp.
1801 *trifolii* Rott. Rare.
1803 *rosea* Harv. Rare.
1807 *picta* Harr. Common.
1808 *cristifera* Walk. Common.
1810 *latex* Gn. Rare.
1812 *adjuncta* Bsdv. 1 sp.
1822 *ligitima* Grt. 1 sp.
1823 *lilacina* Harv. Rare.
1827 *obscura* Smith. Common.
1829 *renigera* Steph. Common.
1832 *olivacea* Morr. Common.
1832*c* *rectilinea* Smith. Rare.
1842 *lorea* Gn. Common.
1850 *vicina* Grt. Rare.

XYLOMIGES Gn.

1892 *simplex* Walk. Rare.

NEPHELODES Gn.

1950 *minians* Gn. Common.
1950*a* *violans* Gn. Common.

HELIOPHILA Hbn.

1953 *unipuncta* Haw. Very Common.
1954 *pseudargyria* Gn. Common.
1957 *luteopallens* Smith. Common.
1962 *rubripennis* G. & R. Very Rare.
1963 *albilinea* Hbn. Common.
1975 *insueta* Gn. Common.
1979 *commoides* Gn. Common.
1980 *phragmitidicola* Gn. Rare.

ORTHODES Gu.

1996 *crenulata* Butl. Rare.
1997 *cynica* Gn. Common.
1998 *vecors* Gn. 1 sp.

CROCIGRAPHA Grt.

2009 *normani* Grt. 1 sp.

GRAPHIPHORA Hbn.

2026 *peredia* Grt. Common.
2040 *alia* Gn. Common.
2043 *subterminata* Smith. Common.
2046 *planalis*. Very Rare.

STRETCHIA Hy. Edw.

2048 *plusiiformis* Hy. Edw. Rare.

TRICHOLITA Grt.

2060 *signata* Walk. Rare.

LITHOMOIA Hbn.

2077 *germana* Morr. Rare.

XYLINA Ochs.

2078 *disposita* Morr. 1 sp.
2090 *antennata* Walk. Rare.
2091 *laticinerea* Grt. Rare.
2092 *grotei* Riley. Rare.
2094 *signosa* Walk. 1 sp.
2095 *innominata* Smith. Rare.
2097 *bethunei* G. & R. Rare.
2100 *fagina* Morr. Rare.
2107 *tepida* Grt. Very Rare.
2108 *baileyi* Grt. 1 sp.
2112 *pexata* Grt. Very Rare.

CALOCAMPA Steph.

2118 *nupera* Lint. Rare.
2120 *cineritia* Grt. Rare.

CUCULLIA Schrank.

2122 *convexipennis* G. & R. Rare.
2127 *asteroides* Gn. Common.

BELLURA Walk.

2147 *gortynoides* Walk. Very Rare.
2148 *diffusa* Grt. Rare.

SPHIDA Grt.

2149 *obliqua* Walk. Rare.

NONAGRIA Ochs.

2150 *permagna* Grt. Common.
2153 *subcarnea* Kell. Common.

ACHATODES Gu.

2158 *zeæ* Harr. Common.

GORTYNA Ochs.

2161 *velata* Walk. Common.
2162 *nictitans* Borkh. Common.

PAPAIPEMA Smith.

2173 *speciosissima* G. & R. Rare.
2178 *purpurifascia* G. &. R. Rare.
2179 *nitela* Gn. Common.
2179*a* *nebris* Gn. Common.
2187 *cataphracta* Grt. Common.
2190 *rutila* Gn. Rare.
2192 *marginidens* Gn. Rare.

PYRRHIA Hbn.

2197 *umbra* Hfn. Common.
2197*a* *exprimens* Walk. Common.

XANTHIA Hbn.

2199 *flavago* Fabr. Common.

JODIA Hbn.

2202 *rufago* Hbn. Common.

BROTOLOMIA Led.

2203 *iris* Gn. Common.

TRIGONOPHORA Hbn.

2204 *periculosa* Gn. Common.
2204*a* *v. brunneum* Grt. Rare.

EUCIRRŒDIA Grt.

2206 *pampina* Gn. Rare.

SCOLIOPTERYX.

2207 *libatrix* Linn. Common.

PSEUDOGLÆA Grt.

2210 *blanda* Grt. Rare.

ANCHOCELIS Gu.

2211 *digitalis* Grt. Rare.

COSMIA Ochs.

2217 *paleacea* Esp. Common.

ORTHOSIA Ochs.

2222 *bicolorago* Gn. Rare.
2222a *ferruginoides* Gn. Very Common.
2230 *helva* Grt. Common.
2231 *lutosa* And. Common.

PARASTICHTIS Hbn.

2235 *discivaria* Walk. Rare.

SCOPELOSOMA Curt.

2236 *indirecta* Grt. Common.
2240 *tristigmata* Grt. 1 sp.
2242 *sidus* Gn. 1 sp.
2243 *morrisonii* Grt. Common.
2244 *devia* Grt. Common.

GLÆA Hbn.

2247 *inulta* Grt. Common.
2249 *sericea* Morr. Very Rare.

HOMOGLÆA Morr.

2256 *hircina* Morr. Rare.

CALYMNIA.

2259 *orina* Gn. Common.

IPIMORPHA.

2261 *pleonectusa* Grt. Common.

CHLORIDEA West.

2296 *virescens* Fab. Rare.

HELIOTHIS Ochs.

2300 *obsoleta (armigera)* Hbn. Very Common.
2300a *umbrosa* Grt. Very Common.
2301 *phlogophaga* G. & R. Rare.
2301a *luteitincta* Grt. Very Rare.
2302 *scutosa* Fabr. Rare.

RHODODIPSA Grt.

2312 *miniana* Grt. Rare.

PORRIMA Grt.

2320 *gloriosa* Strck. Very Rare.

SCHINIA Hbn.

2332 *trifascia* Hbn. Common.
2339 *nundina* Dru. Rare.
2351 *tertia* Grt. Common.
2354 *arcifera* Gn. 1 sp.
2361 *marginata* Haw. Common.
2362 *imperspicua* Strck. Rare.
2366 *atrites* Grt. Very Rare.

EUTHISANOTIA Hbn.

2429 *brevipennis* Strach. Common.
2430 *grata* Fabr. Rare.

PLUSIODONTA Gu.

2464 *compressipalpis* Gn. Rare.

PANCHRYSIA Hbn.

2469 *purpurigera* Walk. Rare.

PLUSIA.

2474 *ærea* Hbn. Common.
2475 *æroides* Grt. Rare.
2476 *balluca* Gey. Common.

EUCHALCIA Hbn.

2478 *contexta* Grt. Common.
2479a *putnami* Grt. Rare.
2480 *venusta* Walk. Very Rare.

EOSPHOROPTERYX Dy.

2481 *thyatiroides* Gn. Rare.

AUTOGRAPHA Hbn.

2485 *biloba* Steph. Rare.
2486 *verruca* Fabr. Rare.
2487 *rogationis* Gn. Common.
2488 *precationis* Gn. Very Common.
2493 *ou* Gn. Rare.
2496 *brassicæ* Riley. Common.
2498 *oxygramma* Gey. Rare.
2502 *octoscripta* Grt. Very Rare.
2505 *rectangula* Kirby. Very Rare.
2509 *selecta* Walk. Rare.
2517 *ampla* Walk. Very Rare.
2519a *simplex* Gn. Very Common.

ABROSTOLA Ochs.
2536 *urentis* Gn. Rare.

OGDOCONTA Butl.
2540 *cinereola* Gn. Rare.

ALABAMA Grt.
2555 *argillacea* Hbn. Very Common.

ANOMIS Hbn.
2556 *erosa* Hbn. Rare.

AMOLITA Grt.
2567 *fessa* Grt. Common.

RIVULA Gu.
2568 *propinqualis* Gn. Common.

EUSTROTIA Hbn.
2601 *albidula* Gn. Common.
2604 *concinnimacula* Gn. Very Rare.
2605 *synochitis* G. & R. Very Rare.
2607 *muscoscula* Gn. Common.
2612 *apicosa* Haw. Common.
2613 *carneola* Gn. Very Common.

GALGULA Gu.
2618 *hepara* Gn. Rare.
2618*a* *partita* Gn. Common.

XANTHOPTERA Gu.
2631 *nigrofimbria* Gn. Rare.

CHAMYRIS Gu.
2656 *cerintha* Tr. Rare.

TARACHE Hbn.
2676 *crastrioides* Gn. Common.
2691 *candefacta* Hbn. Common.

METATHORASA Moore.
2714 *monitifera* Gn. Rare.

EUHERRICHIA Grt.
2716 *mollissima* Gn. Rare.

HYAMIA Walk.
2727 *sexpunctata* Grt. 1 sp.

HOMOPYRALIS Grt.
2734 *contracta* Walk. Rare.

SUBFAMILY CATOCALINÆ.

CISSURA Walk.
2743 *spadix* Cram. Rare.

DRASTERIA Hbn.
2754 *erechtea* Cram. Very Common.
2765 *crassiuscula* Haw. Common.

EUCLIDIA Ochs.
2760 *cuspidea* Hbn. Common.

MELIOPOTIS Hbn.
2767 *nigrescens* G. & R. Rare.
2769 *limbolaris* Gey. Very Rare.

CIRRHBOLINA Grt.
2778 *mexicana* Behr. Rare.

SYNEDA Gu.
2781 *graphica* Hbn. Common.

CATOCALA Schrank.
2813 *vidua* S. & A. 1 sp.
2819 *obscura* Strck. Common.
2820 *residua* Grt. Rare.
2821 *insolabilis* Gn.
2826 *relicta* Walk. Common.
2826*a* *bianca* Hy [illegible]w. Rare.
2826*b* *phrynia* Hy Edw. Rare.
2827 *cara* Gn. Common.
2827*b* *carissima* Hulst. Common.
2828 *amatrix* Hnbn. Rare.
2829 *marmorata* Edw. Common.
2830 *concumbens* Walk. Common.
2848 *unijuga* Walk. Common.
2850 *meskei* Grt. Rare.
2851 *mariana* Hy Edw. Rare.
2854 *briseis* Edw. Common.
2857 *parta* Gn. Common.
2857*a* *perplexa* Strck. Common.
2857*b* *petulans* Hulst. Common.
2864 *ultronia* Hbn. Common.
2864*a* *celia* Hy Edw. Common.
2864*b* *mopsa* Hy Edw. Common.

2870 *neogama* S. & A. Very Rare.
2871 *subnata* Grt. 1 sp.
2872 *cerogama* Gn. Rare.
2873 *palæogama* Gn. Rare.
2882 *serena* Edw. Common.
2884 *antinympha* Hbn. Very Rare.
2887 *habilis* Grt. Common.
2892 *polygama* Gn. Rare.
2902 *grynea* Cram. Common.
2907 *amica* Hbn. Rare.
2907*a* *lineella* Grt. Common.

EUPARTHENOS Grt.

2911 *nubilis* Hbn. Common.

PANAPODA Gu.

2920*b* *roseicosta* Gn. Rare.

PARALLELIA Hbn.

2921 *bistriaris* Hbn. Rare.

REMIGIA Gu.

2923 *repanda* Fabr. Very Common.

POAPHILA Gu.

2928 *quadrifilaris* Hbn. Rare.

ANTICARSIA Hbn.

2948 *gemmatilis* Hbn. Rare.

ANTIBLEMMA Hbn.

2950 *inexacta* Walk. 1 sp.

ZALE Hbn.

2977 *horrida* Hbn. Rare.

YPSIA Gu.

2983 *undularis* Dru. 1 sp.

HOMOPTERA Bdv.

2986 *lunata* Dru. Very Common.
2986*a* *edusa* Dru. Very Common.
2991 *calycanthata* S. & A. Rare.
3000 *unilineata* Grt. Rare.

EREBUS Latr.

3006 *odora* Linn. Very Rare.

THYSANIA Dal.

3007 *zenobia* Cram. Very Rare.

SUBFAMILY HYPNINÆ.

EPIZEUXIS Hbn.

3008 *americalis* Gn. Common.
3009 *æmula* Hbn. Common.
3012 *lubricalis* Gey. Rare.
3016 *rotundalis* Walk. Common.

ZANCLOGNATHA Led.

3019 *lævigata* Grt. Common.
3019*a* *modestalis* Fitch. Common.
3019*b* *reversata* Dy. Common.
3019*c* *obsoleta* Smith. Common.
3024 *ochreipennis* Grt. Common.
3025 *marcidilinea* Grt. Rare.

HORMISA Walk.

3031 *absorptalis* Walk. Common.

PHILOMETRA Grt.

3036 *metonalis* Walk. Common.
3037 *eumelusalis* Walk. Common.

CHYTOLITA Grt.

3039 *morbidalis* Gn. Very Common.
3039*a* *petrealis* Grt. Common.

RENIA Gu.

3048 *flavipunctalis* Gey. Very Common.

BLEPTINA Gu.

3049 *caradrinalis* Gn. Common.

HETEROGRAMMA Gu.

3054 *pyramusalis* Walk. Common.

GABERASA Walk.

3055 *ambigualis* Walk. Common.

PALTHIS Hbn.

3058 *angulalis* Hbn. Common.

LOMANALTES Grt.

3063 *eductalis* Walk. Common.

BOMOLOCHA Hbn.

3065 *baltimoralis* Gn. Rare.
3066 *bijugalis* Walk. Rare.
3067 *scutellaris* Grt. Common.
3068 *abalinealis* Walk. 1 sp.
3070 *sordidula* Grt. Common.
3073 *deceptalis* Walk. Common.
3074 *edictalis* Walk. 1 sp.

PLATHYPENA Grt.

3079 *scabra* Fabr. Very Common.

HYPENA Schrank.

3080 *humuli* Harr. Rare.

NYCTEOLIDÆ.

NYCTEOLA Hbn.

3083*a* *lintnerana* Spey. Rare.

NOTODONTIDÆ.

MELALOPHA Hbn.

3092*a* *ornata* G. & R. Common.
3094 *inclusa* Hbn. Rare.
3094*a* *inversa* Pack. Rare.
3096 *albosigma* Fitch. Rare.

DATANA Walk.

3098 *ministra* Dru. Common.
3100 *angusi* G. & R. Rare.
3106 *perspicua* G. & R. Rare.
3108 *integerrima* G. & R. Common.
3110 *contracta* Walk. Common.

HYPERÆSCHRA Butl.

3111 *stragula* Grt. Rare.

PHEOSIA Hbn.

3118 *dimidiata* H-S. Rare.

LOPHODONTA Pack.

3121 *angulosa* S. & A. Rare.

NADATA Walk.

3123 *gibbosa* S. & A. Common.
3123*a* *doubledayi* Pack. Rare.
3123*b* *rubripennis* N. & A. Very Rare.

SYMMERISTA Hbn.

3125 *albifrons* S. & A. Com-

HETEROCAMPA Doub.

3137 *manteo* Doub. Common.
3140 *biundata* Walk. Very Rare.
3141 *guttivitta* Walk. Common.

IANASSA Walk.

3145 *lignicolor* Walk. Rare.

SCHIZURA Doub.

3148*b* *cinereofrons* Pack. Rare.
3149 *concinna* S. & A. Rare.
3150 *semirufescens* Walk. 1 sp.
3151 *unicornis* S. & A. Rare.

CERURA Schrank.

3160 *occidentalis* Lint. Rare.

HARPYIA Ochs.

3162 *cinerea* Walk. Common.

FENTONIA Butl.

3165 *marthesia* Cram. Rare.

GLUPHISIA.

3166 *septentrionalis* Walk. Common.
3166*a* *ridenda* Hy Edw. Common.

ELLIDA Grt.

3170 *caniplaga* Walk. Very Rare.

THYATIRIDÆ.

HABROSYNE Hbn.

3173 *scripta* Gosse. Rare.

PSEUDOTHYATIRA Grt.

3176 *cymatophoroides* Gn. Rare.
3177 *expultrix* Grt. Common.

LIPARIDÆ.

HEMEROCAMPA Dy.

3190 *leucostigma* S. & A. Very Common.
3192 *definita* Pack. Very Common.

LASIOCAMPIDÆ.

TOLYPE Hbn.

3208 *velleda* Stoll. Common.
3211 *laricis* Fitch. Rare.

MALACOSOMA Hbn.

3214 *americana* Fabr. Common.
3221 *disstria* Hbn. Common.

EPICNAPTERA Ramb.

3223 *americana* Harr. Common.
3223*a* *ferruginea* Pack. Common.

PLATYPTERYGIDÆ.

ORETA Walk.

3226 *rosea* Walk. Rare.
3226*a* *marginata* Walk. Rare.

DREPANA Walk.

3229 *arcuata* Walk. Very Rare.

FALCARIA How.

3231 *bilineata* Pack. Very Rare.

GEOMETRIDÆ.

SUBFAMILY DYSPTERIDINÆ.

DYSPTERIS Hbn.

3232 *abortivaria* H. & S. Rare.

SUBFAMILY HYDRIOMENINÆ.

PALEACRITA Riley.

3245 *vernata* Peck. Very Common.

ALSOPHILA Hbn.

3247 *pometaria* Harr. Rare.

EUDULE Hbn.

3248 *mendica* Walk. Very Common.
3251 *unicolor* Rob. Common.

TALLEDEGA Hulst.

3255 *montanata* Pack. Rare.

NANNIA Hulst.

3260 *refusata* Walk. Very Common.

HETEROPHLEPS H. S.

3262 *triguttaria* H-S. Very Common.

TEPHROCLYSTIS.

3271 *implicata* Walk. Very Rare.
3294 *absynthiata* Clerck. Common.

EUCYMATOGE Hbn.

3327 *intestinata* Gn. Common.

VENUSIA Curt.

3330 *duodecemlineata* Pack. Rare.
3331 *comptaria* Walk. Rare.

EUCHŒCA Hbn.

3332 *albovittata* Gn. Common.
3335 *lucata* Gn. Rare.
3336 *albifera* Walk. Very Common.

HYDRIA Hbn.

3340 *undulata* Linn. Common.

EUSTROMA Hbn.

3348 *diversilineata* Hbn. Common.
3349 *testata* Linn. Very Rare.
3352 *prunata* Linn. Very Rare.

RHEUMAPTERA Hbn.

3359 *hastata* Linn. Rare.
3361 *sociata* Bork. Common.

PERCNOPTILOTA Hulst.

3370 *fluviata* Hbn. Very Common.

MESOLEUCA Hbn.

3371 *ruficilliata* Gn. Common.
3374 *lacustrata* Gn. Very Common.
3375 *implicata* Gn. Rare.
3376 *intermediata* Gn. Common.
3383 *hersiliata* Gn. Rare.

HYDRIOMENA Hbn.

3388 *autumnalis* Ströh. Very Rare.
3401 *multiferata* Walk. Rare.
3402 *latirupta* Walk. Very Common.

TRIPHOSA Steph.

3416 *dubitata* Linn. Common.

CŒNOCALPE Hbn.

3418 *aurata* Grt. Rare.
3419 *magnoliata* Gn. Very Rare.
3426 *gibbocostata* Walk. 1 sp.
3431 *formosata* Strck. Common.

GYPSOCHROA Hbn.

3438 *designata* Hnfn. Common.

PETROPHORA Hbn.

3457 *ferrugata* Clerck. Common.

SUBFAMILY MONOTAXIINÆ.

HÆMATOPSIS Hbn.

3468 *grataria* Fabr. Very Common.

SUBFAMILY STERRHINÆ.

DEPTALIA Hulst.

3477 *insularia* Gn. Common.

COSYMBIA Hbn.

3480 *lumenaria* Hbn. Common.

SYNELYS Hulst.

3487 *ennucleata* Gn. Common.

CINGLIS Gu.

3497 *similaria* Walk. Common.

EOIS, Hbn.

3546 *inductata* Gn. Common.

SUBFAMILY GEOMETRINA.

CHLOROCHLAMYS Hulst.

3561 *chloroleucaria* Gn. 1 sp.

NEMORIA Hbn.

3563 *pistaceata* Gn. Rare.
3564 *subcroceata* Walk. Common.

EUCROSTIS Hbn.

3568 *incertata* Walk. Rare.

APLODES Gu.

3587 *mimosaria* Gn. Rare.

SUBFAMILY ENNOMINÆ.

ORTHOFIDONIA Pack.

3605 *exornata* Walk. Rare.
3608 *vestaliata* Gn. Common.

PSYSOSTEGANIA Warren.

3618 *pustularia* Gn. Rare.

GUENERIA Pack.

3619 *basiaria* Walk. Common.

DEILINIA Hbn.

3623 *variolaria* Gn. Common.

SCIAGRAPHIA Hulst.

3651 *heliothidata* Gn. Com-
3653 *respersata* Hulst. Rare.
3662 *continuata* Walk. Rare.
3664 *mellistrigata* Grt. Common.

PHILOBIA Dupon.

3667 *enotata* Gn. 1 sp.

MACARIA Curt.

3678 *prætomatia* Harvey. Rare.
3682 *septemfluaria* Grt. Common.
3683 *glomeraria* Grt. 1 sp.

CYMATOPHORA Hbn.

3690 *ribearia* Fitch. Common.
3703 *inceptaria* Walk. 1 sp.
3704 *evagaria* Hulst. Common.

3705 *subcessaria* Walk. Common.
3708 *wauaria* Linn. Rare.

HOMOCHLODES Hulst.
3748 *fritillaria* Gn. Common.

APÆCASIA Hulst.
3755 *defluata* Walk. Rare.

NEPYTIA Hulst.
3780 *semiclusaria* Walk. Common.

ALCIS Curt.
3786 *dislocaria* Pack. 1 sp.

PARAPHIA Gu.
3803 *subatomaria* Wood. Rare.
3803a *unipuncta* Haw. 1 sp.

CLEORA Curt.
3850 *pampinaria* Gn. Common.
3855 *larvaria* Gn. Rare.

MELANOLOPHIA Hulst.
3858 *canadaria* Gn. Common.

ÆTHALOPTERA Hulst.
3859 *intextata* Walk. Rare.

ECTROPIS Hbn.
3862 *crepuscularia* D. & S. Very Common.

LYCIA Hbn.
3865 *ursaria* Walk. Rare.
3867 *cognataria* Gn. Common.

PHÆOURA Hulst.
3868 *mexicanaria* Grt. Rare.

NACOPHORA Hulst.
3873 *quernaria* S. & A. Rare.

PHIGALIA Dup.
3881 *titea* Cram. 1 sp.

ERANNIS Hbn.
3884 *tiliaria* Harr. Very Common.

CINGILIA Walk.
3886 *catenaria* Dru. Common.

NEOTERPES Hulst.
3901 *edwardsata* Pack. Very Rare.

SICYA Gu.
3902 *macularia* Harr. 1 sp.

THERINA Hbn.
3907 *pellucidaria* G. & R. Common.

METROCAMPA Latr.
3913 *prægrandaria* Gn. Rare.

EUGONOBAPTA Warren.
3916 *nivosaria* Gn. Very Common.

ENNOMOS Tr.
3922 *subsignarius* Hbn. Rare.
3923 *magnarius* Gn. Common.

XANTHOTYPE Warr.
3925 *crocataria* Fabr. Very Common.

PLAGODIS Hbn.
3927 *serinaria* H-S. Rare.
3928 *keutzingi* Grt. Very Rare.
3930 *alcoolaria* Gn. Common.

HYPERITIS Gu.
3934 *amicaria* H. S. Common.
3934a *alienaria* H. S. Common.

ANIA Steph.
3939 *limbata* Haw. Common.
3939a *expunctaria* Grt. Rare.

GONODONTIS Hbn.
3941 *hypochraria* H. S. Rare.
3944 *duaria* Gn. Common.

EUCHLÆNA Hbn.
3954 *serrata* Dru. Rare.
3960 *johnsonaria* Fitch. Rare.
3963 *astylusaria* Walk. Common.
3965 *pectinaria* D. & S. Rare.

METANEMA Gu.
3981 *inatomaria* Gn. Common.
3982 *determinata* Walk. Common.
3986 *quercivoraria* Gn. Common.

PRIOCYCLA Gu.
3990 *armantaria* H. & S. Rare.

AZELINA Gn.
4001 *ancetaria* Hbn. Rare.

CABERODES Gu.

4007 *confusaria* Hbn. Common.

4007*a* *metrocamparia* Gn. Common.

TETRACIS Gu.

4011 *crocallata* Gn. Common.

SABULODES.

4016 *lorata* Grt. Common.

4026 *transversata* Dru. Common.

ABBOTANA Hulst.

4028 *clemataria* S. & A. Very Rare.

SUBFAMILY SPHÆCELODINÆ.

SPHÆCELODES Gu.

4033 *vulneraria* Hbn. Very Rare.

SUBFAMILY MELANCHROIINÆ.

MELANCHROIA Hbn.

4035 *cephise* Cram. Very Rare.

EPIPLEMIDÆ.

CALLEDAPTERYX Grt.

4044 *dryopterata* Grt. Very Rare.

SUPERFAMILY TINEOIDEA.

NOLIDÆ.

RŒSELIA Hbn.

4055 *minuscula* Zell. 1 sp.

4056 *fuscula* Grt. Common.

LACOSOMIDÆ.

CICINNUS Blanch.

4059 *melsheimeri* Harr. Rare.

COCHLIDIIDÆ.

ADONETA Clem.

4085 *spinuloides* H. S. Rare.

LITHACODES Pack.

4097 *fasciola* H. S. Rare.

PACKARDIA G. & R.

4100*a* *ocellata* Grt. Very Rare.

TORTRICIDIA Pack.

4106 *testacea* Pack. Rare.

COSSIDÆ.

PRIONOXYSTUS Grt.

4147 *robiniæ* Peck. Common.

SESSIDÆ.

SESIA Fabr.

4208 *tipuliformis* Clck. Common.

4221 *ascerni* Clem. Very Common.

PYRALIDÆ.

SUBFAMILY PYRAUSTINÆ.

DESMIA Westw.

4277 *funeralis* Hbn. Common.

PILOCROCIS Led.

4291 *ramentalis* Led. Rare.

BLEPHAROMASTIX Led.

4302 *ranalis* Gn. 1 sp.

4304 *stenialis* Gn. 1 sp.

PANTOGRAPHA Led.

4307 *limata* G. & R. Common.

DIAPHANIA Hbn.

4321 *quadristigmalis* Gn. Common.

EVERGESTIS Hbn.

4336 *straminalis* Hbn. Common.

CROCIDOPHORA Led.
4337 *serratissimalis* Zell. Common.
4339 *tuberculalis* Led. Rare.

NOMOPHILA Hbn.
4342 *noctuella* D. & S. Very Common.

PACHYZANCLA Meyr.
4344 *bipunctalis* Fab. Very Rare.

LOXOSTEGE Hbn.
4346 *coloradensis* G. & R. Rare.
4347 *chortalis* Grt. Rare.
4349 *obliteralis* Walk. Common.
4350 *mancalis* Led. 1 sp.
4354 *similalis* Gn. 1 sp.
4358 *sticticalis* Linn. Common.

THOLERIA Hbn.
4386 *reversalis* Gn. Rare.

PHLYCTÆNIA Hbn.
4401 *ferrugalis* Hbn. Common.
4409 *acutella* Walk. Common.
4410 *terrealis* Tr. Common.
4411 *extricalis* Gn. Common.
4413 *tertialis* Gn. Common.

CINDAPHIA Led.
4414 *bicoloralis* Gn. Common.

EPICORSIA Hbn.
4415 *mellinalis* Hbn. Rare.

PYRAUSTA Schrank.
4417 *pertexalis* Led. Common.
4419 *æglealis* Walk. 1 sp.
4420 *thestealis* Walk. Very Common.
4421 *theseusalis* Walk. Very Common.
4426 *orphisalis* Walk. Common.
4436 *fumalis* Gn. Rare.
4437 *illibalis* Hbn. Rare.
4439 *penitalis* Grt. Common.
4441 *futilalis* Led. Very Rare.
4442 *fumoferalis* Hulst. 1 sp.
4443 *unifascialis* Pack. Common.
4445 *fodinalis* Led. Rare.
4452 *tatalis* Grt. Rare.
4461-1 *signatalis* Walk. Common.
4472 *funebris* Ström. Common.

SUBFAMILY NYMPHULINÆ.

NYMPHULA Schrank.
4487 *icciusalis* Walk. Common.
4489 *gyralis* Hulst. Rare.
4490 *ekthlipsis* Grt. Common.
4491 *allionealis* Walk. Common.
4492 *badiusalis* Walke. Common.
4493 *obscuralis* Grt. Common.
4495 *maculalis* Clem. Rare.
4496 *obliteralis* Walk. Common.

ELOPHILA Hbn.
4499 *bifascialis* Rob. Very Common.
4500 *fulicalis* Clem. Very Common.

DIATHRAUSTA.
4503 *reconditalis* Walk. Rare.

SUBFAMILY SCOPARIINÆ.

SCOPARIA.
4507 *basalis* Walk. Common.
4510 *centuriella* D. & S. Common.

SUBFAMILY PYRALINÆ.

HYPSOPYGIA Hbn.
4513 *costalis* Fabr. Common.

PYRALIS Linn.
4516 *farinalis* Linn. Very Common.

HERCULIA Walk.
4520 *intermedialis* Walk. Rare.
4521 *olinalis* Gn. Common.
4523 *himonialis* Zell. Common.

SUBFAMILY SCHŒNOBINÆ.

SCHŒNOBIUS Dupon.

4543 *unipunctellus* Rob. Rare.
4545 *melinellus* Clem. Rare.
4545b *albicostellus* Fern. Common.
4546 *clemensellus* Rob. Common.
4547 *forficellus* Thunberg. Common.

SUBFAMILY CRAMBINÆ.

CRAMBUS, Fabr.

4558 *hastiferellus* Walk. Common.
4560 *hamellus* Thun. Common.
4564 *girardellus* Clem. Common.
4565 *leachellus* Zinck. Common.
4566 *unistriatellus* Pack. Common.
4567 *præfectellus* Zinck. Rare.
4573 *laqueatellus* Clem. Common.
4574 *alboclavellus* Zell. Very Common.
4575 *agitatellus* Clem. Very Common.
4577 *albellus* Clem. Very Common.
4579 *hortuellus* Hbn. Rare.
4580 *perlellus* Scop. Common.
4581 *turbatellus* Walk. Rare.
4585 *vulvivagellus* Clem. Very Common.
4587 *ruricolellus* Zell. Very Common.
4601 *mutabilis* Clem. Very Common.
4604 *trisectus* Walk. Rare.
4607 *caliginosellus* Clem. Rare.
4608 *zeëllus* Fern. Rare.

THAUMATOPSIS *Morr.*

4612 *pexella* Zell. Common.

ARGYRIA Hbn.

4620 *nivalis* Dru. Common.
4622 *auratella* Clem. Common.

DIATRÆA Guild.

4624 *saccharalis* Fab. Rare.

SUBFAMILY EPIPASCHIINÆ.

EPIPASCHIA Clem.

4637 *superatalis* Clem. Rare.

BENTA Walk.

4648 *asperatella* Clem. Rare.

SUBFAMILY PHYCITINÆ.

ACROBASIS Zell.

4692 *rubrifasciella* Pack. Common.
4695 *hebescella* Hulst. Rare.

MEROPTERA Grt.

4746 *pravella* Grt. Common.

SALEBRIA Zell.

4756 *lævigatella* Hulst. Common.

LAODAMIA Rag.

4776 *fusca* Haw. Common.

LÆTILIA Rag.

4842 *coccidivora* Comst. Rare.

HULSTEA Rag.

4849 *undulatella* Clem. Rare.

HOMŒOSOMA Curt.

4865 *electellum* Hulst. Rare.

SUBFAMILY ANERASTINÆ.

SALURIA Rag.

4905 *tetradella* Zell. Common.

PEORIA Rag.

4911 *approximella* Walk. Common.

PTEROPHORIDÆ.

OXYPTILUS Zell.

4932 *periscelidactylus* Fitch. Common.
4934 *ningoris* Wals. 1 sp.
4935 *tenuidactylus* Fitch. Rare.

PLATYPTILIA Hbn.

4941 *carduidactyla* Ril. Rare.
4944 *fragilis* Wals. Common.

PTEROPHORUS Geof.

4962 *homodactylus* Walk. Common.
4964 *elliottii* Fern. Common.
4973 *paleaceus* Zell. Common.
4981 *monodactylus* Linn. Common.

TORTRICIDÆ.

SUBFAMILY OLETHREUTINÆ.

EXARTEMA Clem.

5015 *permundanum* Clem. Common.
5019 *punctanum* Wals. 1 sp.
5021 *fasciatanum* Clem. Common.
5023 *exoletum* Zell. Common.

OLETHREUTES Hbn.

5031 *nimbatana* Clem. Common.
5034 *dimidiana* Sod. Common.
5047 *chionosema* Zell. Common.
5056 *coruscana* Clem. Common.
5071 *bipartitana* Clem. Common.

EUCOSMA Hbn.

5090 *albiguttana* Zell. Rare.
5101 *giganteana* Ril. 2 sp.
5104 *fulminana* Wals. 1 sp.
5106 *bipunctella* Walk. 1 sp.
5115 *canana* Wals. 1 sp.
5129 *strenuana* Walk. 1 sp.
5139 *scudderiana* Clem. Common.
5140-1 *obfuscana* Clem. Rare.
5142 *otiosana* Clem. Common.
5144 *dorsisignatana* Clem. Common.

THIODIA Hbn.

5165 *formosana* Clem. Rare.
5177 *striatana* Clem. Rare.

PROTEOPTERYX Wals.

5213 *deludana* Clem. Common.
5214 *spotiana* Clem. Very Common.
5217 *costomaculana* Clem. Rare.

PROTEOTERAS Ril.

5219 *æsculanum* Ril. Common.

HEMIMENE Hbn.

5289 *simulana* Clem. 1 sp.

MELISSOPUS Ril.

5295 *latiferreanus* Wals. 1 sp.

CYDIA Hbn.

5296 *pomonella* Linn. Common.

SUBFAMILY TORTRICINÆ.

ALCERIS Hbn.

5309 *hastiana* Linn. Common.

EPAGOGE Hbn.

5331 *sulfureana* Clem. Rare.

CENOPIS Zell.

5335 *reticulatana* Clem. Common.
5336 *pettitana* Rob. Rare.
5339 *groteiana* Fern. 1 sp.

CŒLOSTATHMA Clem.

5344 *discopunctana* Clem. Very Rare.

SPARGANOTHIS Hbn.

5349 *xanthoides* Walk. Rare.

ARCHIPS Hbn.

5356 *rosaceana* Harr. Common.
5357 *purpurana* Clem. Common.

5362 *paralella* Rob. Common.
5365 *argyrospila* Walk. Rare.
5368 *fervidana* Clem. Common.
5375 *virescana* Clem. Common.
5377 *clemensiana* Fern. Common.
5380 *melaleucana* Walk. Common.

PLATYNOTA Clem.

5387 *sentana* Clem. Rare.

TORTRIX Linn.

5401 *bergmanniana* Linn. Rare.
5404 *fucana* Wals. Common.
5406 *fumiferana* Clem. 2 sp.

EULIA Hbn.

5418 *ministrana* Linn. Rare.

AMORBIA Clem.

5429 *humerosana* Clem. Rare.

GELECHIIDÆ.

GNORIMOSCHEMA Busck.

5620 *gallæsolidaginis* Riley. Common.

TRICHOTAPHE Clem.

5655 *flavocostella* Clem. 1 sp.
5664 *setosella* Clem. 1 sp.

GELECHIA Hbn.

5744 *discoocellella* Chamb. 1 sp.

XYLORICTIDÆ.

STENOMA Zell.

5834 *schlægeri* Zell. Rare.

ŒCOPHORIDÆ.

MACHIMIA Clem.

5853 *tentoriferella* Clem. Rare.

DEPRESSARIA How.

5854 *atrodorsella* Clem. 1 sp.
5858 *pulvipennella* Clem. 1 sp.
5889 *heracliana* De Geer. 1 sp.

SEMIOSCOPSIS Hbn.

merricella Dy. Very Rare.

ETHMIA Hbn.

5907 *semilugens* Zell. Very Common.
5912 *longimaculella* Chamb. Common.
5913 *zelleriella* Chamb. Rare.

BLASTOBASIDÆ.

HOLOCERA Clem.

5979 *glandulella* Clem. 1 sp.

ELACHISTIDÆ.

SCYTHRIS Hbn.

6107 *basilaris* Zell. 1 sp.

TINEIDÆ.

ARGYRESTHIA Hbn.

6455 *andereggiella* Dup. Rare.

XYLESTIA Clem.

6476 *pruniramiella* Clem. 1 sp.

TINEA Linn.

6515 *misella* Zell. 1 sp.

IN MEMORIAM.

ADOLPH MEINECKE.

Mr. Adolph Meinecke, the subject of this sketch, was born on August 16, 1830, in Burhave, Grand Duchy of Oldenburg, on the German Sea. His father, Dr. Ferdinand Meinecke, was a physician and a man of liberal culture, who had traveled widely and who frequently entertained visitors from foreign lands, the recipients of his hospitality being often scientific men of high reputation. Brought up amid such surroundings there was aroused in the boy an interest in travel, and an enthusiasm for science and art. The love for the higher things of life, which ever remained a part of his character, probably had its beginnings in these early influences.

When very young he attended the village school, but in his thirteenth year he entered the Gymnasium at Oldenburg. Later, we find him taking a business course at the Commercial College of Osnabruck, Westphalia. Even at this early date, the English language was taught in the business colleges of Germany. At the age of seventeen the boy was working in the office of a ship chandler, but he was now pondering upon his future career and before his next birthday he left Germany for America, beginning life in his new home in 1847, with twenty six dollars in his pocket. For the ensuing year he earned two dollars a week, and thereafter, for some time, three dollars a week, in an importing house; and in 1851 he was left in entire charge of the business, when the owner went abroad, at the munificent salary of four dollars a week.

In 1854 he was married to Miss Maria Louise Kraft of New York, and in 1855 they moved to Milwaukee. Mr. Meinecke, after looking over the field, decided to engage in the toy business. His former employer gave practical proof of his confidence by lending him $6,000 with which to lay the foundations of his enterprise. From being confined to a small retail store on East Water St. his business gradually increased until it occupied an entire block and, in time, it became a large wholesale importing house. As early as 1864 he began the manufacture of willow baskets and bamboo furniture. The supply of material in this state being limited, it became necessary for him to introduce the growing of willows by the farmers and it was through him that the manufacture of willow ware became common throughout Wisconsin.

From 1854 until 1893 he was occupied with the active affairs of business life. When ill health compelled him to retire he was succeeded by his eldest son, Ferdinand Meinecke.

However greatly Mr. Meinecke may have contributed to the commercial activity of the state, a still greater claim to our respect is found in his warm interest in the more ideal side of the life of our city, as shown by his active interest in its educational institutions. He was one of the foremost in establishing, maintaining and developing the Englemann museum, which subsequently became the foundation of the Milwaukee Public Museum; and after this transfer had been made he was one of the most intelligent and devoted members of the Board of Trustees. His interest, moreover, was not limited to attendance at the meetings of the Board since the list of his various donations to the Museum is a long one. His hatred of cruelty and injustice led him to participate in the work of the Humane Society which he served for some time as Vice-President. His lively interest in Natural History brought him into this Society and he was for many years a constant attendant at its meetings.

It is in men like Mr. Meinecke, who are surrounded by the solid and tangible rewards of industry and practical power, but who, looking over and beyond these, are mindful of the broader aspects of life upon which real progress depends, that the community finds its surest hope for the days to come.

LIST OF MEMBERS OF THE WISCONSIN NATURAL HISTORY SOCIETY.

ACTIVE MEMBERS.

Allen, Clarence J.	555 Juneau Place.
Altschwager, Hugo	118 Harmon St.
Bartlett, Dr. Edwin W.	422 Jefferson St.
Barth, Dr. George P.	Goldsmith Bldg.
Batchelor, Dr. Wm. A.	1109 Kinnickinnick Ave.
Biersach, Adolph	1011 Second St.
Blatz, Val.	236 Prospect Ave.
Bossert, Gottlob	719 Franklin Place.
Brown, Charles E.	1214 Chestnut St.
Brues, Charles T.	Public Museum.
Carpenter, Charles G.	841 Cass St.
Case, Dr. Ermine C.	2513 Wells St.
Clowes, Herbert	Public Museum.
Copeland, Dr. Ernest	141 Wisconsin St.
Denton, Miss Minna C.	Milwaukee-Downer College.
Doerflinger, Charles	3425 Cedar St.
Eiring, B. H.	2819 Cedar St.
Elser, John	472 Cass St.
Finger, Wm.	297 Twelfth St.
Fischer, Alfred	751½ Island Ave.
Fischer, Davenport	422 East Water St.
Gallun, Mrs. Albert F.	456 Lafayette Place.
Graenicher, Dr. S.	551 Seventh St.
Gray, Dr. Nathaniel	514 Goldsmith Bldg.
Hummel, Walter H.	1039 Third St.
Habhegger, O. J.	762 Jackson St.
Jung, Phillipp	623 Second St.
Kiewert, Charles L.	9 Waverly Place.
Koeffler, Charles A.	909 Pabst Bldg.
Lando, Julius	419 East Water St.
Laue, Adolph F.	1111 Sycamore St.
Lange. Dr. C. F.	900 First St.
Lotz, Louis	615 Galena St.
Lutz, Hugo	1248 Burleigh St.
Mann, Charles L.	124 Farwell Ave.
Meinecke, Ferdinand	623 Milwaukee St.
Merrill, Miss Harriett B.	Public Museum.
Miller, Benj. J. Jr.	102 Wisconsin St.
Mitchell, I. N.	State Normal School.
Monroe, Charles E.	800 Pabst Bldg.
Monsted, A.	507 Pabst Bldg.
Ogden, Dr. Henry V.	518 Goldsmith Bldg.
Orth, William	723 27th St.
Peckham, Dr. George W.	Public Library.
Pereles, J. M.	529 Astor St.

Pereles, Thomas J.	535 Astor St.
Philipp, Richard M.	596 Jackson St.
Quarles, Charles	539 Farwell Ave.
Reuss, Gustav	668 Sixth St.
Rohde, Paul C.	635 Second St.
Russell, Howland	106 Mason St.
Schnellenmeyer, Miss Fanny	648 First St.
Sherman, Dr. Lewis	448 Jackson St.
Shrosbree, George	Public Museum.
Steinmeyer, Mrs. Mary	2427 Grand Ave.
Stickney, Gardner P.	Pabst Bldg.
Teller, Edgar E.	165 27th St.
Thal, Carl	Public Museum.
Trieschmann, Charles	430 Hanover St.
Tweedy, John H.	508 Marshall St.
Uihlein, August	332 Galena St.
Vogel, William H.	108 Seventh St.
Vogel, Fred. Jr.	583 Cass St.
Ward, Henry L.	Public Museum.
Winkler, General Fred. C.	131 Eleventh St.
Yunker, Charles H.	2520 Cedar St.

CORRESPONDING MEMBERS.

Buckley, Dr. E. R.	Rolla, Mo.
Clarke, W. P.	Milton, Wis.
Frieden, Henry W.	Mineral Point, Wis.
Hollister, N.	Delavan, Wis.
Jackson, H. H. T.	Carthage, Mo.
Jones, Miss Clara G.	West Bend, Wis.
Kuehne, Rudolph	825 N. 8th St. Sheboygan, Wis.
Lyman, F. H.	205 Market St., Kenosha, Wis.
Miller, Dr. D. McL.	Oconomowoc, Wis.
Mitchell, Rev. E. C.	534 Summit Ave., St. Paul, Minn.
Schuette, G. H.	Manitowoc, Wis.
Severson, Henry P.	Winneconne, Wis.
Skavlem, Henry L.	Janesville, Wis.
Slocum, Dr. Charles E.	Defiance, Ohio.
Winkenwerder, H. A.	Sheboygan, Wis.

Milwaukee

BULLETIN
OF THE
WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 4, New Series. JULY, 1906. No. 3.

PROCEEDINGS.

April 26, 1906.

Regular monthly meeting of the society and annual meeting.

President Teller in the chair and about 75 persons present.

Owing to the considerable amount of business to be transacted, the lecture of the evening was given before the business meeting.

Mr. H. L. Ward spoke on "Some Factors in Bird Study," a popular exposition of some of the underlying principles of ornithology.

The speaker referred first to the peculiarities of ancient birds, referring to the Archæopteryx, or earliest known bird, found fossil in the rocks of the Jurassic period. It had a long cat-like tail, teeth, and three separate fingers ending in claws. Another fossil bird, the Hesperornis, from the Tertiary rocks, more like modern forms, with shortened tail and teeth was also described.

Among modern birds the difference in development and condition at birth were shown in relation to the habits of different birds. The evolution of different parts of the body, such as feathers, bills, and feet, as adapted to environment, and the formation of sub-species by climate revealed the constant changes brought about by adaptation to different sorts of surroundings.

Especially interesting is the question of protective coloration of eggs and the birds themselves, whereby they escape their enemies on account of being colored like surrounding objects. In this connection the bright colors of males of some species in which the females are of inconspicuous appearance was mentioned as was also the varying coloration at different ages and seasons.

Special adornments of birds, particularly during the breeding season, were described, and the speaker made an appeal against the barbarity of using these for hat ornaments and otherwise.

The lecture was illustrated by colored steropticon views of the specimens referred to. It closed with a consideration of the nests and nesting habits of birds.

The business meeting followed after five minutes' intermission.

The minutes of the last monthly meeting were read and approved.

Mr. Ward read a letter from the Archeological Society asking if the Natural History Society would be willing to transfer volumes I and II of the Wisconsin Archeologist to them, as they now publish this journal.

Mr. Ward was asked by the chair to see what arrangement could be made with the Archeological Society.

Mr. Otto J. Habbegger was proposed for membership and elected by the Board of Directors.

The Treasurer's report was read by the Secretary and accepted.

Mr. C. L. Mann renominated the present incumbents in office to serve in their respective positions for the ensuing year. Seconded.

Mr. Finger requested that another name be substituted for his as Treasurer, and Mr. Thal was nominated. Mr. Ward suggested that this would be placing the society in too close connection with the museum, as two members of the Board of Directors were at present on the staff of the Public Museum. After some discussion and persuasion Mr. Finger consented to serve, and all were unanimously elected as follows:

President, Mr. E. E. Teller.
Vice-President, Mr. H. L. Ward.
Treasurer, Mr. Wm. Finger.
Secretary, Mr. C. T. Brues.
Member of Board of Directors, Dr. S. Graenicher.

The Secretary reported that the first number of the Bulletin for 1906 was ready to go to press and complained of the difficulty of obtaining articles sufficient to keep the Bulletin filled.

There being no further business the meeting adjourned.

Milwaukee, May 30, 1906.

Regular monthly meeting of the society.

President Teller in the chair.

The minutes of the April meeting were read and approved.

Mr. Ward reported that he had not yet heard regarding the proposed transfer of the Wisconsin Archeologist to the Archeological Society.

The Secretary reported that the April number of the Bulletin was in the hands of the printer and would be ready for distribution within a few days.

There being no further business, Prof. I. N. Mitchell spoke on "Birds and Their Values." The speaker referred especially to the value of birds in destroying noxious insects. His talk was illustrated by a number of lantern slides of the species mentioned.

Dr. S. Graenicher then spoke on "The Economic Importance of Insects as Cross-fertilizers of Flowers." He referred to the great value of insects to fruit growers, on account of their necessary presence to secure pollination of fruit trees. He also described the introduction of Red Clover into New Zealand and the subsequent introduction of European bumble bees as fertilizers of the clover. He outlined briefly the factors necessary to be considered in selecting a suitable species of bee.

Mr. H. L. Ward followed with an account of the organization of the "Association of American Museums." He outlined the origin and hopes of the new association which he said was primarily intended to facilitate the exchange of ideas between museum men for mutual benefit. He referred also to the great changes recently inaugurated in museums all tending to make the museum an institution of greater value to those not especially interested in scientific subjects.

The meeting then adjourned.

June 28, 1906.

Regular monthly meeting of the Society.

In the absence of President Teller, Vice-President Ward presided.

Mr. Doerflinger called the attention of the society to the fact that the 6th of May, 1907, would be the fiftieth anniversary of the founding of the society, and suggested that some suitable celebration be planned. The matter was referred to the Executive Committee.

There being no further business, Mr. C. T. Brues, of the Public Museum, spoke on "The Wingless Condition of Certain Insects in Relation to Current Theories of Evolution and Variation." The speaker reviewed briefly the conceptions of variation and mutation and their relation to the origin of new species. He outlined the causes generally accepted to account for the origin of variations. The condition of the wings in a number of subapterous genera of beetles was described and the possibility of applying the theory of mutation to them. The correlation between the wing-length in subapterous species and climate was also mentioned.

Dr. Graenicher asked the society for expressions of opinion as to the effects of introducing squirrels into city parks on the nesting of song birds in these places. Considerable discussion followed by various members.

The meeting then adjourned.

NOTES ON WISCONSIN MOLLUSCA.

BY GEORGE H. CHADWICK.

During the summer of 1902, the writer was engaged in rearranging the shell collections of the Milwaukee Public Museum. With the encouragement of the custodian (now the director) of the museum and the active assistance of the members of the Wisconsin Natural History Society, an effort was made to commence a collection of the shells of Wisconsin. The greater part of the local collecting was carried on outside of working hours, in company with Mr. Charles E. Brown of the museum staff, and numerous accessions were received from other members and friends who became interested in the work. Many of these voluntary contributors brought specimens from distant or out-of-the-way points reached on business or pleasure trips, thus materially extending our knowledge of the distribution of the species. These localities and contributors are specified beyond. The results of this ten weeks' occasional collecting, in a season not the most favorable for shell-hunting, are summarized in the present paper. It is hoped that they may be the beginning of a complete census of the Wisconsin mollusca.

The names of those who added, often most generously and unremittingly, to the growth of this collection are these, the numeral following each indicating the total number of accessions by species credited to that name:

Charles E. Brown	306	Benno Meyer	1
Ernest Bruncken	22	Chas. E. Monroe	43
William H. Ellsworth	9	Henry Nesbitt	38
G. H. Chadwick	153	William Orth	3
William Finger	8	H. Rossebo	5
Valentine Fernekes	31	Mr. Selle	11
G. Friend	5	E. E. Teller	6
Dr. S. Graenicher	23	Miss Alice Ward	1
Henry P. Hamilton	8	Philip Wells	44
Simon Heller	2	Miss Olive C. Wheeler	21
H. A. Kirchner	1	Lee R. Whitney	6
Adolph F. Laue	4	Mrs. E. C. Wiswall (exchange)	3
Hon. Publius V. Lawson	10		
Hugo Lutz	1		

The figures given in this list are open to some correction, especially since, when collectors collaborated, the full tally of species jointly obtained has been credited separately to each. A grateful acknowledgment is due to all the above named, and to some others, but especially to Miss Wheeler, Dr. Graenicher, Mr. Fernekes, Mr. Bruncken, Mr. Wells and Mr. Monroe. Above all, the untiring efforts of Mr. Brown and the kindly interest of Mr. Henry L. Ward, director of the museum, have made the undertaking successful.

In our tramps around the City of Milwaukee, which was the only area explored at all thoroughly, the following were the favorite collecting grounds—the Menomonee valley, and its slopes, westward from the Wells street viaduct to Wauwatosa; the valley of the Milwaukee river, from Coney Island to and above Lindwurm; the lake bluffs at Whitefish Bay and southward; the shore of Lake Michigan northward from the pumping stations; the Menomonee marshes below Mitchell park; and Johnson's woods, west of the Soldiers' Home.

A single expedition along the valley of Mud Creek yielded abundant returns, especially *Sphæriidæ,* while the Kinnickinnic, Honey Creek, the city parks and greenhouses, and the woods south and southwest of the city proved good soil, worthy of further cultivation.

Other locality records within the county of Milwaukee are Oak's farm, Cudahy, Mr. E. E. Teller; County line, Ernest Bruncken; Oak Creek, near South Milwaukee, G. Friend; towns Greenfield and Franklin, several records, C. E. Brown. The more remote general locality records throughout the state are:

Kenosha County, Kenosha, Mrs. E. C. Wiswall.
" " Sand Ridge Creek, C. E. Brown.

Waukesha County, Big Bend, C. E. Brown.
" " Delafield, Lee R. Whitney.
" " Okauchee, V. Fernekes.
" " Okauchee Lake, Miss O. C. Wheeler.
" " Golden Lake, William Finger.

Washington County, Cedar Lake, Dr. S. Graenicher.
" " Little Cedar Lake, William Orth.

Sheboygan County, Elkhart Lake, A. F. Laue.

Winnebago County, Menasha, Hon. P. V. Lawson.
" " Winneconne, Hon. P. V. Lawson.
" " Boom, A. F. Laue.

Calumet County, Lake Winnebago, C. E. Monroe.

Manitowoc County, Jambo Creek, C. E. Brown.
" " Molas Creek, C. E. Brown.
" " Kika, C. E. Brown.
" " Mishicot, C. E. Brown.
" " Two Rivers, C. E. Brown.
" " Two Rivers, C. E. Brown.

Oneida County, Maple Lake, W. H. Ellsworth.
" " Clear Water Lake, W. H. Ellsworth.

La Crosse County, La Crosse, H. Nesbitt.

Additional localities from museum specimens and citations in the literature include Humboldt and Smithville, Milwaukee County; Racine; Nashotah, Waukesha County; Lake Koshkonong; Aztalan, Jefferson County; Rock River; Sheboygan; Sugar River at Broadhead, Green County; Madison and Four Lakes, Dane County; Dodgeville, Iowa County; Baraboo, Sauk County; Oshkosh, Winnebago County; Clem and Junction Lakes and She-she-pe-comeo Park, Waupaca County; Green Bay, Brown County; Oconto; Richland City, Richland County; Mississippi river, between Prairie du Chien and De Soto (Crawford County); Wisconsin river, and Lakes Ellen and Leota.

It will be seen that large areas in the state remain to be canvassed, particularly in the northern and western portions.

Local material already in the museum collections has been freely drawn upon and is listed fully under each species, with its museum number and the name of the collector. A considerable part of this material consists of polished "Unios", purchased from Mrs. E. C. Wiswall, and bearing, almost without exception, the very indefinite locality, "Wisconsin." Despite the small value of such data for purposes like the present, the species will be found admitted to the list on their own recognizance, as all are likely to occur within the borders of the state. Additional records have been derived from an exchange list of Kenosha shells submitted by Mrs. Wiswall during her residence there, and from lists of further accessions, later received through Mr. Brown, including that of the Bunde & Upmeyer collection of Mississippi river bivalves from Crawford County. All these are accompanied in the lists by the name of their sponsor.

Lastly, all citations of Wisconsin localities in the authorities consulted have been incorporated, with page reference. This has been done in spite of some repetition, and all the available literature (up to 1902) has been searched in order to have the record historically complete. Many important papers have no doubt been neglected through lack of acquaintance with them, but for such omissions no one will feel greater regret than the writer.

The works actually consulted, and which will be found of service to all students of the local mollusc fauna, are the following:

"The Mollusca of the Chicago Area," by F. C. Baker, published in two parts as Bulletin No. III of the Chicago Academy of Sciences. This very complete monograph, with its excellent half tone illustrations, covers nearly all the species found around Milwaukee and well serves the needs of the local student. In it are given full directions for collecting and cleaning shells, a glossary of terms, and other helps.

The Smithsonian "Miscellaneous Collections," including Binney's "Land and Fresh Water Shells of North America," in Vols. VII and VIII, Tryon's "Monograph of the Strepomatidæ," in Vol. XVI, and Prime's "Monograph of the Corbiculadæ," in Vol. VII. Binney's "American Land Shells" is a revision of a portion of the above.

Pilsbry and Johnson's "Land Shells of America north of Mexico," a classified check-list with localities, which costs twenty cents.

Simpson's "Synopsis of the Naiades," published as Proceedings No. 1205 of the U. S. National Museum, is a complete systematic and synonymic catalogue of the Unionidæ and allied forms.

Tryon's "Manual of Conchology," a monographic descriptive work appearing annually, includes at present our land shells.

"The Nautilus," the official American conchological journal. Condensed lists of the material which forms the subject of this paper have recently appeared in its pages.

All of the above are available in the public library of the city, or in the library of the museum. In addition, the writer has had recourse to Vols. 1 to 4 of the American Journal of Conchology, Gould's "Invertebrata of Massachusetts" (Binney's reprint), DeKay's "Mollusca" in the New York State Natural History series, Call's "Mollusca of Indiana," Hartman's "Conchologia Cestrica," and certain bulletins of the Smithsonian Institution.

Bryant Walker's "Mollusca of Michigan" ought also to be of assistance to the Wisconsin collector.

In the lists which follow, no attempt has been made to put forth a scientific classification of the species, as that is not germane to the purpose of the paper. The record is primarily that of faunal distribution, and the various forms have therefore been grouped for convenience as "land shells," "fresh water univalves" and "bivalves," the genus *Carychium* being included with the first named. In the order of arrangement, Pilsbry and Johnson's list has been followed for the land shells and Simpson's Synopsis for the Unionidæ. The arrangement of the fresh water univalves is mainly that of Baker's Chicago Area Mollusca.

Under each species there is given, first, the localities furnished by our own collecting, beginning with those in and about Milwaukee, from the north around westward to the south, then the more remote accessions throughout the state, commencing with the southern and nearest; second, material previously in the museum; third, records from lists submitted and accessions since reported to me; lastly, citations from the literature, notes and comments. The numbered species are those authenticated by our own collecting, as recently published in the Nautilus.

For assistance in the identification of species the writer's thanks are gratefully tendered to Dr. Victor Sterki of New Philadelphia, Ohio, who has examined all the Sphæriidæ and Pisidiidæ; to Mr. Frank C. Baker of the Chicago Academy of Sciences, who made a rapid preliminary survey of the smaller fresh water forms; and to Messrs. Bryant Walker of Detroit, and Chas. T. Simpson of Washington, as acknowledged beyond. Further assistance has recently been rendered by Mr. Brues of the museum.

It should be explained, finally, that the present paper is written from the standpoint of 1902, such later information being included only as came readily to hand. The extensive collections since made by the museum, and the more recent literature, will furnish the basis for a supplementary notice, which it is intended shall be prepared in the autumn.

The material collected is all in the Public Museum of the City of Milwaukee.

I. LAND SHELLS.

1. **Helicina occulta** Say.

Lake bluffs at and south of Whitefish Bay resort. "Sheboygan, Wis. (fossil), I. A. Lapham," Smith Misc. Coll., VII, 112 "Brown Co., Wis.," Nautilus, III, 113. "Sheboygan, Whitefish Bay, near Milwaukee, and near De Pere, Wis. * * Distribution markedly discontinuous and local," Pilsbry and Johnson, catalogue, p. 2. See also Naut., III, 18, 20, for notes on distribution of this species.

The rediscovery of this interesting little operculate land shell at Whitefish Bay is due to Dr. Graenicher. The species was found to be moderately abundant under stumps and in the leaves and grass on the wooded slope of the bluffs, especially about half a mile south of the resort. It was here associated with a dozen other species of snails and slugs. The reddish color, shoe-button like shape, and above all, the presence of the operculum, will enable Helicina to be readily recognized on sight.

In the public library copy of the Smithsonian Miscellaneous Collections (VII, 112) above referred to, is the following interesting note written in pencil after the description of the present species:

"Finding a number of *living* specimens of this shell at Milwaukee, I submitted them to Mr. W. G. Binney for examination. He reported that without doubt they were ***Helicina occulta***, thus satisfactorily settling a long mooted point. E. R. L."

The initials stand, I am told, for E. R. Leland, but the date of the annotation is unknown.

2. **Helix pomatia** Linné.

This, the large edible snail of Europe, is reported by Philip Wells as taken alive in a vacant lot on the northeast corner of State and Fifteenth streets. One of the two specimens secured was presented to the museum by Mr. Wells. Repeated search has failed to further confirm the habitat, and the species cannot therefore be considered an established resident.* It is not included in Pilsbry and Johnson's Catalogue of American Land Shells. The site of its capture is said to be the scene of former "snail banquets" for which great numbers of this species were imported. Judging from our unfortunate experience with other introduced forms, it is not likely to prove a desirable addition to our fauna, however alluring to the palate.

Helix (Tachea) nemoralis Linné.

Reported doubtfully from Baraboo, Sauk Co., Wis., Naut., VI., 131. See also Pils. & Johns. Cat., p. 3. A native of Europe.

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* In a letter received from Mr. Brown since the above was penned, is the following: "In clearing away the bushes and rubbish on the old Milwaukee Garden site (Fourteenth and State streets), several additional specimens of the large European edible snail were found. This makes five altogether. These are probably the last, as the site is now almost entirely occupied by dwellings and large flat buildings."

3. **Vallonia pulchella** Müller.

Union Cemetery; Mud Creek valley, common; near the Teller mounds above Lindwurm; near Kraatz's brickyard; Cabeen's farm, south of city. 3074, near Wauwatosa, W. M. Wheeler. Kenosha, Mrs. E. C. Wiswall's list.

The specimens collected appertain to the typical form as distinguished by Dr. Sterki, but those from Lindwurm approach somewhat *V. excentrica,* Sterki.

Polygyra (Triodopsis) inflecta Say.

"Milwaukee, Wis., I. A. Lapham." Smith. Misc. Coll., VIII, 129. Our collecting failed to confirm this citation.

4. **Polygyra (Triodopsis) profunda** Say.

Lake bluffs, north and south of Whitefish Bay resort, abundant; North Point; Lindwurm, and north; near Kraatz's brickyard; Menomonee river dredgings; woods south of Wauwatosa; Reynolds' woods near Layton Park; Hale's Corners, Town Greenfield; Crystal Lake, near Elkhart Lake, Sheboygan Co. Near Smithville, Milw. Co., W. M. Wheeler. Kenosha, Mrs. E. C. Wiswall. "Milwaukee, Wis., I. A. Lapham," Smith. M. C., VIII, 153.

5. **Polygyra (Triodopsis) albolabris** Say.

Whitefish Bay resort; Johnson's woods, and woods south of Wauwatosa; (?) Oak's farm, Cudahy (juv.); 3076, Smithville, Milw. Co., and 3077 (juv.), near Wauwatosa, W. M. Wheeler. "Milwaukee, Wis., I. A. Lapham," and "Rock River, Wis.," Smith. Misc. Coll., VIII, 138.

This species, the dominant Polygyra of the eastern states, is not common around Milwaukee, where P. profunda displaces it in relative abundance. Only occasional dead shells were collected, some approaching *P. exoleta* in form, but lacking the tooth of the latter.

6. **Polygyra (Triodopsis) multilineata** Say.

Milwaukee river at Schlitz' ice-house; Kinnickinnic valley at Eleventh avenue; Hale's Corners, Town Greenfield; Menomonee river dredgings. 3079, Humboldt, Wis., W. M. Wheeler. Kenosha, Mrs. Wiswall's list. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VIII, 140.

Like the preceding species, only dead shells were taken.

Polygyra (Triodopsis) elevata Say.

"Wisconsin," Pilsbry and Johnson, Catalogue, p. 13.

This did not appear in the collections, and it is not reported by Baker from the Chicago area.

7. **Polygyra (Triodopsis) thyroides** Say.

Wauwatosa; Johnson's woods; Kinnickinnic valley, near Eleventh avenue. Kenosha, Mrs. Wiswall's list. "Wisconsin, I. A. Lapham," S. M. C., VIII, 148.

This species also is scarce, no living specimens being taken.

Polygyra (Triodopsis) clausa Say.

"Wisconsin," Binney, Smithsonian Misc. Coll., VIII, 149. Said to live on the leaves of the elderberry (Sambucus), Naut., III, 132. "Western Pennsylvania to Minnesota," Pilsbry and Johnson.

This species was not reported.

8. **Polygyra (Stenotrema) hirsuta** Say.

Valleys of the Milwaukee, Menomonee and Kinnickinnic; North Point; Mishicot, Manitowoc Co., under conifers. 2997, Humboldt, Wis., W. M. Wheeler. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VIII, 119.

9. **Polygyra (Stenotrema) monodon** Rackett.

Menomonee valley and woods near Wauwatosa. 2996, Humboldt, W. M. Wheeler. Kenosha, Mrs. Wiswall's list.

An edentate specimen was collected near Wauwatosa, and two others from the Menomonee river dredgings.

9a. **Polygyra monodon fraterna** Say.

Lake bluffs, north and south of Whitefish Bay resort; Castalia Park; Johnson's woods; Reynolds' woods at Layton Park; Oak's farm, Cudahy; Oak Creek, near South Milwaukee. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VIII, 123.

Polygyra monodon leai Ward.

"Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VIII, 123. This form did not occur in the collections.

10. **Strobilops affinis** Pilsbry.

Lake bluffs, south of Whitefish Bay; Menomonee valley above Wells street viaduct; Oak's farm, Cudahy; Mishicot, Manitowoc Co., under conifers.

Our original identification of the species as above is confirmed by Dr. Sterki. The specimens vary toward *S. virgo* in exhibiting but six internal laminæ, hence the reference to the latter species in the preliminary list published in the Nautilus.

Strobilops labyrinthica Say.

"Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VIII, 85. As the species of this genus have been but recently discriminated, this may refer to the preceding.

11. **Pupoides marginatus** Say.

(syn. **Leucocheila fallax,** Say.)

Kenosha, Mrs. E. C. Wiswall. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VIII, 240.

It is somewhat remarkable that this species should have eluded us at Milwaukee, where it will undoubtedly be found in the more open places, under stones.

12. **Bifidaria (Albinula) armifera** Say.

Whitefish Bay resort and bluffs to south; Menomonee valley at Kraatz's brickyard and Castalia Park. 5787, Humboldt, Wis., W. M. Wheeler. Kenosha, Mrs. E. C. Wiswall's list. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VIII, 242.

13. **Bifidaria (Albinula) contracta** Say.

Bluffs south of Whitefish Bay resort; Menomonee valley at Castalia Park; Johnson's woods; Mitchell's woods at Layton Park.

14. **Bifidaria (Albinula) corticaria** Say.

Menomonee valley at Castalia Park, Wauwatosa. "Milwaukee, Wis., I. A. Lapham," Smith. M. C., VIII, 246.

15. **Bifidaria (Vertigopsis) curvidens** Gould.

Johnson's woods, Wauwatosa, rare.

16. **Bifidaria (Vertigopsis) pentodon** Say.

Menomonee valley above Wells street; Mitchell's woods near Layton Park; Teller mounds near Lindwurm.

17. **Vertigo (Angustula) milium** Gould.

Mitchell's woods, west of Layton Park.

18. **Vertigo ovata** Say.

Root river at Loomis road, Town Franklin. 3188, Smithville, Milw. Co., W. M. Wheeler. Kenosha, Mrs. Wiswall's list. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VIII., 253.

19. **Cochlicopa lubrica** Müller.

Bluffs south of Whitefish Bay; Menomonee valley at Castalia Park. Kenosha, Mrs. Wiswall's list. She-she-pe-comeo Park, Waupaca Co., C. E. Brown, 1903.

20. **Vitrina limpida** Gould.

Mud Creek valley east of North Milwaukee; Castalia Park; rare. For interesting notes on this species see the Nautilus, VII, 47, 95; IX, 94. It is not reported from the Chicago area.

21. **Vitrea cellaria** Müller.

Nehrling greenhouse, Milwaukee, C. E. Brown (museum specimens, unnumbered). Brought on plants from Japan, where it had been introduced from Europe.

22. **Vitrea draparnaldi** Beck.

Currie and Mitchell Park greenhouses. Another importation from Europe which seems to have come by the western route through the Pacific seaboard.

23. **Vitrea hammonis** Ström.

Mud Creek valley at North Milwaukee and eastward; Menomonee valley, Wells street to Castalia Park; Dahlman's woods; Chicago avenue at Cabeen's farm.

24. **Vitrea (Glyphyalina) indentata** Say.

Lake bluffs south of Whitefish Bay; Menomonee valley above Wells street viaduct.

25. **Euconulus fulvus** Müller.

A single specimen only occurred, in a lot of shells whose locality label was unfortunately lost. The general assemblage of species suggests the Menomonee valley above Wells street as the probable source, but this is a pure guess. Kenosha, Mrs. E. C. Wiswall's list.

26. **Zonitoides nitidus** Müller.

Mud Creek valley throughout; Menomonee valley at Twentieth street, common. 5788, Humboldt, Wis., W. M. Wheeler. Lindwurm, C. E. Brown.

27. **Zonitoides arboreus** Say.

Bluffs south of Whitefish Bay; Mud Creek valley near Teutonia avenue; Menomonee valley, from Twentieth street to Castalia Park; Johnson's woods; Oak's farm, Cudahy; Mishicot, Manitowoc Co., under conifers. Kenosha, Mrs. Wiswall's list. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VIII, 34.

28. **Zonitoides (Pseudohyalina) minusculus** Binney.

Mud Creek valley; Menomonee valley above Wells street; Mitchell's woods, Layton Park. Kenosha, Mrs. Wiswall's list.

29. **Limax maximus** Linné

Currie, Mitchell Park, and Pollworth greenhouses, and vicinity of the latter. A troublesome form, likely to spread to houses and gardens, first reported to us by Mr. Kirchner. Imported to the C. C. Pollworth houses in 1901, with palms from Belgium, and now (1902) common on the premises.

30: **Limax flavus** Linné

Currie greenhouse and garden. The name should stand "*Limax (Lehmannia) variegatus* Draparnaud, var. ***flavus***, Moquin-Tandon," according to Cockerell, Nautilus, III, 86

31. **Agriolimax agrestis** Linné

Bluffs south of Whitefish Bay; Mud Creek valley throughout, Menomonee valley near Washington avenue; Soldiers' Home; Currie and Mitchell Park greenhouses; abundant in Washington Park and generally throughout the city. A troublesome nocturnal visitant of kitchen gardens. It is interesting to find these three common European slugs already firmly implanted so far inland.

The present species does not appear to have reached Chicago, however.

32. **Agriolimax campestris** Binney.

Lake bluffs south of Whitefish Bay; Mud Creek valley at North Milwaukee; Menomonee valley above Wells street; Currie greenhouses. Unlike the exotic species this is not very common anywhere.

33. **Philomycus (Pallifera) dorsalis** Binney.

Lake bluffs south of Whitefish Bay resort.

No one who has described this species seems to have mentioned the reddish color of the mouth and forward margins of the foot. This was very noticeable in the three specimens obtained above, and in others observed by me in Monroe county, New York, recalling the colors of the animal in the next species. It is probably a constant character of this form, and does no indicate a variety as at first supposed.

34. **Pyramidula (Patula) alternata** Say.

Lake bluffs north and south of Whitefish Bay resort; Milwaukee river valley at Coney Island and mouth of Mud Creek; Menomonee river dredgings and valley above Wells street; woods south of Wauwatosa, Johnson's woods, Reynolds' woods; Hale's Corners, Town Greenfield; Oak's farm, Cudahy; Oak Creek, near South Milwaukee; Mishicot, Manitowoc Co., under conifers. 5720, Humboldt, W. M. Wheeler. Johnson's woods, A. W. Slocom. 11132, Baraboo, Mrs. E. C. Wiswall. Kenosha, Mrs. Wiswall's list. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VIII, 76.

One of the most abundant species everywhere.

35. **Pyramidula (Gonyodiscus) perspectiva** Say.

One very typical specimen only, from the bluffs south of Whitefish Bay (the Helicina locality), verifies the citation in Smith. Misc. Coll., VIII, 80, "Milwaukee, Wis., I. A. Lapham." The species is not recorded from the Chicago area; see Baker, Moll. Chic. Area, p. 212.

36. **Pyramidula (Gonyodiscus) striatella** Anthony.

Bluffs south of Whitefish Bay; Mud Creek valley at North Milwaukee and at mouth: Menomonee valley, from Twentieth street to Castalia Park; Chicago avenue at Cabeen's farm; Oak's farm, Cudahy; Root river, at Loomis road, Town Franklin. 3023, Milwaukee Co., W. N. Wheeler. Kenosha, Mrs. Wiswall's list.

36a. **Pyramidula striatella catskillensis** Pilsbry.

Johnson's woods, in roots of an oak tree; Mishicot, Manitowoc Co., under conifers. See Naut. XII, 86; XIII, 70.

The occurrence of this interesting mutation, so remote from its type locality, is worthy of special notice. There seems no question of the identification, or of the distinctness of characters.

37. **Helicodiscus lineatus** Say.

Whitefish Bay resort and bluffs to south; Menomonee valley from Soldiers' Home to Castalia Park. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VIII, 53.

Punctum pygmæum Draparnald.

(?) Bluffs south of Whitefish Bay resort. Identification of single dead shell doubtful.

38. **Succinea ovalis** Say.

(syn. **Succinea obliqua,** Say.)

Milwaukee River valley below Schlitz ice-house; Mud Creek valley at North Milwaukee, abundant and large; Menomonee river dredgings, and valley at Castalia Park and Wauwatosa; Reynolds' woods, Layton Park. "Milwaukee, Wis. (*obliqua*), I. A. Lapham," Smith. Misc. Coll., VIII, 266.

38a. **Succinea ovalis** Say, **var.**

A form approaching *var. totteniana* was taken in the Mud Creek valley near Teutonia avenue, and at Castalia Park, Wauwatosa.

39. **Succinea retusa** Lea.

(syn. **Succinea ovalis** Gould, not Say.)

Ogden-Copeland arboretum, near Whitefish Bay; Mud Creek valley from North Milwaukee to mouth; Menomonee valley, near Mitchell Park and above Wells street; Honey Creek, near Layton Park; Cabeen's woods, Chicago avenue. Kenosha (as ovalis, Gould), Mrs. Wiswall's list. "Milwaukee, Wis,, I. A.

Lapham" (as ovalis), Smith. Misc. Coll., VIII, 258. Less common than the preceding.

40. **Succinea avara** Say.

Bluffs south of Whitefish Bay; Mud Creek valley at North Milwaukee; Castalia Park, Wauwatosa; southwest quarter of section 16, Town Greenfield; Chicago avenue at Cabeen's farm; Mishicot river at Two Rivers, Manitowoc Co.

41. **Carychium exiguum** Say.

Menomonee valley at Soldiers' Home, above Wells street viaduct and at Castalia Park. 3187, damp woods near Smithville, Milwaukee Co., W. M. Wheeler. Kenosha, Mrs. Wiswall's list. "Milwaukee," in pencil in library copy of Smith. Misc. Coll., VII, 6.

41a. **Carychium exiguum exile** H. C. Lea.

With the preceding, and intergrading so closely with it as to make even varietal separation difficult. Dr. Sterki would refer the entire series of Carychium above recorded to "a small, slender form of var. of exiguum, although in shape somewhat like exile." In either case the connection of these two nominal species is indicated by the Wisconsin material.

II. FRESH-WATER UNIVALVES.

A. PULMONATE.

42. **Limnæa stagnalis appressa** Say.

Menomonee river dredgings and at Wauwatosa; Oak Creek, near South Milwaukee; mill pond at Delafield, Waukesha Co., very abundant; Ballad's cottage, Okauchee lake, white variety; East Twin river at Two Rivers, Manitowoc Co.; Lake Winnebago, west of High Cliff, Calumet Co. Kenosha, Mrs. E. C. Wiswall's list. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 29.

Limnæa (Radix) decollata Mighels.

"Madison, Wis., I. A. L.," pencil note in margin of the public library copy of the Smithsonian Miscellaneous Collections, VII, 31. Not verified.

43. **Limnæa (Radix) columella** Say.

Mill pond near Nagawicka Lake, Delafield. "Milw." in pencil, Smith. Misc. Coll., VII, 32.

44. **Limnæa (Bulimnea) megasoma** Say.

Molas Creek, Manitowoc Co. 3248, Lake Koshkonong, Jefferson (?) Co. "Oconto, Wis., Geo. T. Marston," Naut., V, 81.

45. **Limnæa (Limnophysa) reflexa** Say.

Stream near electric light plant, Wauwatosa; pool in Johnson's woods, abundant and variable; Menomonee river dredgings; Kinnickinnic river near Eleventh avenue; pond in Cabeen's woods, old Chicago road; Oak Creek, near South Milwaukee; Sand Ridge Creek, southeast of Kenosha; mill pond at Delafield, abundant. Kenosha, Mrs. Wiswall's list. "Milwaukee, Wis., I. A. Lapham; Farwell's woods, Madison, Wis., Prof. S. F. Baird; Aztalan, Wis., Prof. Baird; Milwaukee, Lewis," Smith. Misc. Coll., VII, 41.

No attempt has been made to discriminate the supposed varieties to which names have been applied. When it is difficult sometimes even to separate this species satisfactorily from the following, further niceties must be left to those who have abundant leisure. The large series from a single pond in Johnson's woods illustrates well the possibilities of variety-making afforded by this species.

Specimens placed alive in an aquarium were cleaned out by dragon-fly larvæ.

46. **Limnæa (Limnophysa) palustris** Müller.

(syn. **Limnæa elodes** Say.)

Small pools near the Milwaukee river opposite the cement works; Menomonee river dredgings; pool in Johnson's woods, feeding on a carcase; hollow by roadside near Cabeen's woods, Chicago avenue; north shore of Lake Winnebago, west of High Cliff. 12657, Johnson's woods, C. E. Brown. "Oshkosh, Lake Winnebago, Wis., A. C. Barry; Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 47.

"Var. michiganensis," Walker, occurs among the specimens from Johnson's and Cabeen's woods.

47. **Limnæa (Limnophysa) catascopium** Say.

On the lake beach at Lake Park and the flushing tunnel pumping station, in the sand. Single dead shells were also obtained from the stream near the electric light plant, Wauwatosa, and Chicago avenue at Cabeen's farm. These stragglers are insufficient to show that this species extends beyond the waters of Lake Michigan at Milwaukee. It would be interesting to know the depth of water which is the normal habitat, the beach specimens being all drifted material.

47a. **Limnæa catascopium** Say, **var.**

With the preceding occur shorter forms approaching *L. emarginata.*

Limnæa (Limnophysa) emarginata Say.

(?) Kenosha, Mrs. E. C. Wiswall's list, under the name *L. ampla,* Say. "Madison, Wis., I. A. Lapham; Wisconsin, Lewis." Smith. Misc. Coll., VII, 53. "First of Four Lakes, Madison, Wis., P. P. Carpenter," Baker, Bull. Chic. Acad. Sci., Vol. II, No. III, p. 195. For the habits of the var. mighelsi, Binney, see Naut. XIV, 8. Not collected around Milwaukee.

48. **Limnæa (Limnophysa) caperata** Say.

Small swamp southwest of Humboldt Park and Honey Creek, near Layton Park; north shore of Lake Winnebago, west of High Cliff. Kenosha, Mrs. Wiswall's list. Overflow pond of Milwaukee river at Lindwurm, C. E. Brown, 1903. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 57. Grades into the following nominal variety.

48a. **Limnæa caperata umbilicata** Adams.

Small pools near the Milwaukee river opposite the cement works; Mud Creek, at North Milwaukee; Honey Creek, near Layton Park, with intermediate forms; hollow beside Chicago avenue, near Cabeen's farm; small creek near Loomis road, Town Greenfield; ponds at Howard's prairie and near St. Martin's, Town Franklin; Sand Ridge Creek, near lake shore, Kenosha.

49. **Limnæa (Limnophysa) humilis** Say.

Milwaukee river at Lindwurm; Mud Creek at North Milwaukee; Menomonee river, near old Falk brewery; Honey Creek, near Layton Park; doubtfully from Lake Winnebago, west of High Cliff. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 67. Everywhere scarce.

50. **Limnæa (Limnophysa) desidiosa** Say.

Mud Creek and its valley at and east of North Milwaukee; artificial pond near Kraatz's brickyard, Vliet street; Menomonee river, near old Falk brewery and in slough above Castalia Park; Honey Creek, near Layton Park (*L. parva* in part, fide F. C. Baker); Lake Winnebago, west of High Cliff; Mishicot river, at Two Rivers, Manitowoc Co. 12659, Cold Spring avenue, fossil. "Milw." in pencil, Smith. Misc. Coll., VII, 48, public library copy. A considerable portion of the above were referred to the preceding species by Mr. Baker on a hasty examination, but in this I cannot follow him.

Limnæa (Acella) gracilis Jay.

"Has been quoted from Wisconsin," Smith. Misc. Coll., VII, 69.

51. **Planorbis (Helisoma) trivolvis** Say.

Lake Michigan beach at North Point pumping station; stream near electric light plant, Wauwatosa; Menomonee river dredgings; Kinnickinnic river, near Eleventh avenue; lily-pond in South Park; mill pond at Delafield; Okauchee, and Ballad's cottage, Okauchee Lake, Waukesha Co.; north shore of Lake Winnebago, Calumet Co.; East Twin river, at Two Rivers, Manitowoc Co. Kenosha, Mrs. Wiswall's list. "Madison, Wis., Prof. S. F. Baird; Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 121.

51a. **Planorbis trivolvis** Say, **large form.**

Molas Creek, Manitowoc Co. 3946, Sheboygan, C. M. Wheatley collection, as *P. "corpulentus."* This seems to be the form which has frequently been confounded with *Planorbis corpulentus* Say, a western species. See the Nautilus, XIII, 133; XIV, 33.

52. **Planorbis (Helisoma) bicarinatus** Say.

Menomonee river dredgings; Menomonee valley, near Castalia Park; stream near electric light plant, Wauwatosa; Honey Creek, near Layton Park; Kinnickinnic river, near Eleventh avenue; Golden Lake, Waukesha Co.; Little Cedar Lake, Washington Co.; north shore of Lake Winnebago, Calumet Co. Kenosha, Mrs. Wiswall's list. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll. VII, 124.

52a. **Planorbis bicarinatus striatus** Baker.

Cold Spring Park (fossil), donated by Mr. Monroe. 12660, Cold Spring avenue (fossil). "Milwaukee (fossil), C. E. Brown," Nautilus, XV, 120, original description.

53. **Planorbis (Planorbella) campanulatus** Say.

Lake Michigan beach at North Point pumping station and near Lake Park; Menomonee river dredgings; stream near electric light plant, Wauwatosa; Kinnickinnic river, near Eleventh avenue; fossil at Cold Spring Park; mill pond at Delafield, Okauchee and Golden Lake, Waukesha Co.; Little Cedar Lake, Washington Co.; Crystal Lake, near Elkhart Lake; Sheboygan Co.; north shore of Lake Winnebago, Calumet Co.; East Twin River, at Two Rivers, Manitowoc Co. Kenosha, Mrs. Wiswall's list. "Milwaukee, Wis., I. A. Lapham; Aztalan, Wis., S. F. Baird," Smith. Misc. Coll., VII, 110.

Some of the specimens from Golden Lake show the curious distortion, due to a second growth after the formation of the first aperture, that is so often observed in senile examples of *P. trivolvis*. This phenomenon is rather unusual in the present species.

Planorbis (Menetus) exacutus Say.

"Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 128. Our search for this species was unsuccessful.

54. **Planorbis (Gyraulus) hirsutus** Gould.

Mishicot river (or East Twin river), at Two Rivers, Manitowoc Co., not uncommon.

55. **Planorbis (Gyraulus) parvus** Say.

Mud Creek valley at North Milwaukee; Menomonee valley, opposite Mitchell Park, and at Castalia Park, abundant; Honey Creek, near Layton Park; ponds at Howard's prairie and near St. Martin's, Town Franklin.

56. **Segmentina (Planorbula) armigera** Say.

Mud Creek valley at North Milwaukee, abundant; slough at mouth of Mud Creek; Castalia Park, Wauwatosa; Johnson's woods; marsh in Menomonee valley, opposite Mitchell Park; dry pond at Cabeen's woods, Chicago avenue; pond near St. Martin's, Town Franklin; Mishicot river, at Two Rivers, Manitowoc Co. Kenosha, Mrs. Wiswall's list. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 138.

Ancylus (Lævapex) diaphanus Haldeman.

"Milwaukee, Wis., I. A. Lapham," Smith, Misc. Coll., VII, 141.

57. **Ancylus (Ferrissia) rivularis** Say.

Root river, at Loomis road, Town Franklin. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII., 143.

58. **Ancylus (Ferrissia) parallelus** Haldeman.

Pond near St. Martin's, Town Franklin. The unique specimen obtained was submitted to Mr. Bryant Walker, who corroborates the identification and writes: "The shell is a good example of the compressed, high form of parallelus that occurs occasionally. (See Naut., XVIII, p. 77, Plate V, fig. 4-6.) It seems to be an individual variation and not a varietal one."

59. **Ancylus** sp.

A single dead shell from an artificial pond near Kraatz's brickyard, west along Vliet street, is considered by Mr. Bryant Walker to represent a new species. See Naut., XVIII, 81.

In all only five specimens of Ancylus were secured, which is disappointing, for a much larger number of species should be found on industrious search in the proper places. The genus has recently been elaborately monographed by Mr. Bryant Walker in volumes XVI to XVIII of the Nautilus.

Physa heterostropha Say.

Kenosha, Mrs. Wiswall's list. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 89. It may be questioned whether these citations appertain properly to this species as now delimited. See Baker, Mollusca of the Chicago Area, p. 308, and Nautilus, VI, 20; XIV, 16; XV, 25. A single immature shell from the mill pond at Delafield, Waukesha Co., is doubtfully referred here.

60. **Physa sayi** Tappan.

Lake Michigan at the pumping stations; Menomonee marshes and dredgings; Kinnickinnic river, near Eleventh avenue; Golden Lake, Waukesha Co.; north shore of Lake Winnebago, near High Cliff, Calumet Co. This species evidently prefers a lake habitat, but is nowhere very abundant.

Physa ampullacea Gould, a west coast species, is marked "Milwaukee" in pencil in the library copy of Smith. Misc. Coll., VII, 79. This must be an error for sayi or gyrina; compare figure 134 of the above work with the Mud Creek specimens of *P. gyrina.*

61. **Physa gyrina** Say.

Milwaukee river, near Coney Island, and at Lindwurm; Mud Creek valley, common; small pond near Kraatz's brickyard; slough above Castalia Park; pool in Johnson's woods; Menomonee marshes and dredgings; Honey Creek, near Layton Park; dry pond at entrance to Cabeen's woods, Chicago avenue, abundant and large, burrowing in the mud; pond near St. Martin's, Town Franklin; small creek near Loomis road, Town Greenfield; small creek at County Line; Sand Ridge Creek, near Kenosha; north shore of Lake Winnebago, Calumet Co.; East Twin river, at Two Rivers, Manitowoc Co. Kenosha, Mrs. Wiswall's list. "Milwaukee, Wis., I. A. Lapham; Farwell's Mills, Madison, Wis., S. F. Baird; Racine, Wis., ditto," Smithsonian Misc. Coll., VII, 79.

61a. **Physa gyrina elliptica** Lea.

(**Physa gyrina oleacea** Tryon.)

Mud Creek, east of North Milwaukee; Honey Creek, near Layton Park; small swamp southwest of Humboldt Park. Not always readily separated from the typical form of the species, and occurring with it.

62. **Physa integra** Haldeman.

Lake Michigan beach at and near North Point; Milwaukee river, near Coney Island (nice series), at Lindwurm and below Schlitz icehouse; Mud Creek, at North Milwaukee; pond near Kraatz's brickyard; Menomonee river, at Castalia Park and Wauwatosa, and stream near Wauwatosa electric light plant; Root river, at Loomis road, Town Franklin; Golden Lake, Waukesha

Co. "Wisconsin," F. C. Baker, Naut., XIV, 16; Moll. Chic. Area, p. 316. In the older citations, this form was commonly confused with *P. heterostropha,* which it largely replaces in the Milwaukee region.

63. **Aplexa hypnorum** Linné.

Menomonee valley, near old cattle chute; pools in Johnson's woods. Kenosha, Mrs. Wiswall's list. Over-flow pond of the Milwaukee river at Lindwurm, large numbers, C. E. Brown, 1903. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 101.

B. OPERCULATE.

64. **Pleurocera subulare** Lea.

var. pallidum? Lea.

North shore of Lake Wninebago west of High Cliff, Calumet Co. Mr. Baker provisionally identified the specimens as pertaining to the above variety. They are of a light horn yellow color, the earlier whorls with several incised revolving lines and a faint median carina.

65. **Pleurocera elevatum** Say.

Milwaukee river at Lindwurm and below the Schlitz icehouse, the latter representing the form *tractum,* Anthony. Also from the Menomonee river dredgings.

66. **Goniobasis livescens** Menke.

Lake Michigan, at the pumping stations and Lake Park; Milwaukee river at Lindwurm and near Coney Island; doubtfully from the Kinnickinnic river, near Eleventh avenue; Menomonee river dredgings. 2816, Milwaukee river. Kenosha, Mrs. Wiswall's list. The specimens from the lake shore are frequently more or less battered, often with a perforation in the body whorl.

Goniobasis livescens depygis Say.

"Wisconsin (*M. occulta* Anthony)," Smith. Misc. Coll., XVI, 248. Walker, Naut., XVI, 35, suggests that this is a good species. It did not occur in our collections.

Bythinia tentaculata Linné.

"Wisconsin," Baker, Mollusca Chic. Area, p. 330. Our collecting failed to find this introduced species, which may be looked for any day at Milwaukee, having established itself through the Great Lakes system and become exceedingly abundant at Rochester, N. Y., Chicago, etc.

67. **Amnicola limosa** Say.

Sandy beach of Lake Michigan, north from flushing tunnel pumping station; Milwaukee river at Lindwurm; Lake Winnebago, west of High Cliff, Calumet Co. Kenosha, Mrs. Wiswall's list. "Madison and Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 84.

67a. **Amnicola limosa parva** Lea.

North bank of Milwaukee river at Lindwurm; Castalia Park, Wauwatosa, in stream "drift."

67b. **Amnicola limosa porata** Say.

Lake Michigan beach at the pumping stations.

68. **Amnicola lustrica** Pilsbry.

Honey Creek, near Layton Park.

69. **Amnicola (Cincinnatia) cincinnatensis** Lea.

Milwaukee river at Lindwurm; Menomonee River dredgings; Lake Winnebago, near High Cliff, Calumet Co. It is doubtful whether this species appertains to the genus Amnicola; see Walker, Naut., XVI, 35. The spelling of the specific name requires emendation as above.

70. **Amnicola (Cincinnatia) emarginata** Küster.

North shore of Lake Winnebago, west of High Cliff, Calumet County.

71. **Somatogyrus subglobosus** Say.

Kinnickinnic river, near Eleventh avenue; Root river, at Loomis road, Town Franklin; Kenosha (Mrs. Wiswall); Lake Winnebago, near High Cliff, Calumet Co. "Wisconsin," Moll. Chicago Area, p. 341.

Somatogyrus integer depressus Tryon.

Kenosha, Mrs. Wiswall's list.

72. **Pomatiopsis lapidaria** Say.

Castalia Park, Wauwatosa. 2788, near cement mills, Milwaukee Co., Wis., W. M. Wheeler. Kenosha, Mrs. Wiswall's list. "Richland City, Wis.," in pencil in library copy of Smith. Misc. Coll., VII, 93.

Pomatiopsis lustrica Say (= **P. lapidaria**).

"Four Lakes, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 95. See Baker, Moll. Chic. Area, pp. 334, 344.

73. **Valvata tricarinata** Say.

Milwaukee river below Schlitz icehouse; Mud Creek, at and east of North Milwaukee; Honey Creek, near Layton Park; Cold Spring Park (fossil); Lake Winnebago, near High Cliff, Calumet Co. "Milwaukee, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 12.

73a. **Valvata tricarinata simplex** Gould.

Shore of Lake Michigan, north from flushing tunnel pumping station.

Valvata bicarinata Say
form normalis Walker.

Specimens from Mud Creek at North Milwaukee having the characters supposed to distinguish this form are probably merely the young of *V. tricarinata.*

74. **Valvata sincera** Say.

Honey Creek, near Layton Park; fossil at Cold Spring Park. 12658, Cold Spring avenue (fossil). "Madison, Wis., I. A. Lapham," Smith. Misc. Coll., VII, 13.

75. **Vivipara contectoides** W. G. Binney.

Kinnickinnic river, near Eleventh avenue, one dead shell only. As this may have been brought on a boat, further evidence is needed before fully admitting the species to the Wisconsin fauna. It is well established at Chicago. For the history of its colonization in northern waters, see Amer. Jour. Conch., IV., 245; Nautilus, V, 133.

Vivipara subpurpurea Say.

"Wisconsin," W. G. Binney, Smith. Misc. Coll., VII, 21.

76. **Campeloma rufum** Haldeman.

Ballad's cottage, Okauchee Lake, Waukesha Co.; Little Cedar Lake, Washington Co.; Lake Winnebago, near High Cliff, Calumet Co. Beasley Brook, Waupaca Co., C. E. Brown, Aug., 1903.

77. **Campeloma decisum** Say.

Milwaukee river at Lindwurm and below Schlitz icehouse; Menomonee river, near old Falk brewery and at Wauwatosa; Kinnickinnic river, near Eleventh avenue; Root river, at Loomis road, Town Franklin; Lake Winnebago, near High Cliff, Calumet Co. (doubtful); East Twin river, at Two Rivers, Manitowoc Co. 2858 (*"integrum"*), Milwaukee river (doubtful). Kenosha (as *"Melantho integra"*), Mrs. Wiswall's list. "Milwaukee, Wis., I. A. Lapham; Aztalan and Racine, Wis., S. F. Baird," Smith. Misc. Coll., VII, 51. The following has generally been confused with this species, and is so difficult to separate from it that the distinction may be properly challenged. I am not at all sure of the correctness of the identifications here given.

78. **Campeloma subsolidum** Anthony.

Milwaukee river at Lindwurm and below Schlitz icehouse; Menomonee river dredgings and at Mitchell Park and Wauwatosa; Kinnickinnic river near Eleventh avenue; Oak Creek, near South Milwaukee; Molas Creek, Manitowoc Co.

79. **Lioplax subcarinata** Say.

Kenosha, Mrs. E. C. Wiswall exchange; Lake Winnebago, near High Cliff, Calumet Co. Not reported by Baker from the Chicago area.

III. BIVALVES.

80. **Lampsilis ventricosa*** Barnes.

Milwaukee river at Lindwurm and below the Schlitz icehouse; Lake Winnebago, near High Cliff, Calumet Co.; Clear Water

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* Some emendations are necessary in the orthography of the Unionidæ, as pointed out by Josua Lindahl, "Orthography of the Names of the Naiades," Journal of The Cincinnati Society of Natural History," Vol. XX, No. 2, p. 235, Feb. 1, 1906.

Lake Creek, Oneida Co. 7244, Dodgeville, Iowa Co., R. Marks. 11037, 11039, "Wisconsin River," Wiswall collection as "*U. canadensis.*" Clem Lake, Waupaca Co., C. E. Brown, Aug., 1903. Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown. "Lake Ellen, Wis. (*canadensis*), Dr. J. J. Brown," Naut., V, 81.

Lampsilis occidens Lea.

"In the Lea collection from Nashotch, Wis.," as "*Unio cariosus,*" but probably belonging to this species; see Naut., VIII, 123. The locality is evidently a misspelling for Nashotah, Waukesha Co. According to Dr. von Ihering, XV, 50, this species is not a synonym of the preceding, but distinct. *Lampsilis cariosa* Say, is not otherwise reported from Wisconsin. The three forms, ventricosa, occidens, and cariosa, are all very similar and difficult to distinguish.

81. **Lampsilis (Eurynia) luteola** Lamarck.

Milwaukee river, above Lindwurm; Golden Lake and Ballad's cottage, Okauchee Lake, Waukesha Co.; Boom, and ancient shell heaps at Winneconne, Winnebago Co.; Lake Winnebago, near High Cliff, Calumet Co. (doubtful); Two Rivers, Manitowoc Co.; Clear Water Lake and Creek, Oneida Co.. 12652, Fox River, near Big Bend, Waukesha Co., C. E. Brown. 11016, 11017, "Wis.," Wiswall collection. Beasley Brook, She-she-pe-comeo Park, Waupaca Co., C. E. Brown, Aug., 1903.

Lampsilis (Eurynia) superiorensis Marsh.

One specimen, from Two Rivers, Manitowoc Co., may represent this northerly race. For description, see the Nautilus, X, 103; Pl. I, p. 121.

Lampsilis (Eurynia) borealis A. F. Gray.

Said to connect with luteolus "in Wisconsin," Naut., V, 88; also 113.

Lampsilis (Eurynia) radiata Gmelin.

"There is a shell in the U. S. National Museum from the northwest boundary of Wisconsin, which is probably this species."—Simpson, Synopsis, p. 536.

82. **Lampsilis (Eurynia) ligamentina** Lamarck.

Milwaukee river at Lindwurm and below Schlitz icehouse;

Fox River, near Big Bend, Waukesha Co.; Winnebago Lake, at Menasha (doubtful); Clear Water Lake Creek, Oneida Co. 10687, Sugar River, Brodhead, Green Co., W. H. Hayssen. **11023**, "Wisconsin River," Wiswall collection. Honey Creek, Towns Wauwatosa and Greenfield, several specimens, C. E. Brown, Oct., 1903. Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

Lampsilis (Eurynia) higginsi Lea.

Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

Lampsilis (Eurynia) anodontoides Lea.

Same locality as preceding.

83. **Lampsilis (Eurynia) recta** Lamarck.

Fox River, near Big Bend, Waukesha Co., pathologic; La Crosse. 11054, "Wis.," Wiswall collection, C. E. Brown. For Crosse. 11054, "Wis.," Wiswall collection. Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown. For the identification of the remarkably deformed specimen from Big Bend, we are indebted to Mr. Chas. T. Simpson, author of the "Synopsis."

84. **Lampsilis (Eurynia) iris** Lea.

Milwaukee river at Lindwurm. "Wisconsin," Simpson, Syn. Naiades, p. 552.

85. **Lampsilis (Eurynia) ellipsiformis** Conrad.

(syn. **Lampsilis spatulatus** Lea.)

Milwaukee river at Lindwurm and below Schlitz icehouse, abundant; Fox river, near Big Bend, Waukesha Co.; mill pond at Hika, Manitowoc Co. 3429, Milwaukee river, A. Kerr. **11003**, "Wis.," Wiswall collection.

86. **Lampsilis (Proptera) alata** Say.

Winnebago Lake at Menasha, and west of High Cliff, Calumet Co.; Two Rivers, Manitowoc Co. 5764, Milwaukee River, Wis. Nat. Hist. Soc. 11021, "Wis.," Wiswall collection. Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

87. **Lampsilis (Proptera) gracilis** Barnes.

Boom, and north branch of the Fox River at Menasha, Winnebago Co.; Winnebago Lake, near High Cliff, Calumet Co. 3404, Milwaukee River, Wis. Nat. Hist. Soc. 11022, "Wis.," Wiswall collection. Our collecting failed to corroborate the Milwaukee river locality.

Obovaria (Pseudoön) ellipsis Lea.

11030, "Wis.," Wiswall collection.

Plagiola securis Lea.

Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

Plagiola (Amygdalonaias) elegans Lea.

11012, "Wis.," Wiswall collection.

88. **Plagiola (Amygdalonaias) donaciformis** Lea.

Kinnickinnic river, near Eleventh avenue; La Crosse. 11080, "Wis.," Wiswall collection.

A single valve only from the Milwaukee locality, which is therefore questionable.

Tritogonia tuberculata Barnes.

10693, Sugar river, Brodhead, Green Co., H. H. Hayssen. 10998, 10999, "Wis.," Wiswall collection. Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

89. **Strophitus edentulus** Say.

Milwaukee river, from Lindwurm to the Schlitz icehouse; Kinnickinnic river, near Eleventh avenue, young; mill pond at Hika, Manitowoc Co. 11042, "Wis.," Wiswall collection. Beasley brook, She-she-pe-comeo Park, Waupaca Co., C. E. Brown, Aug., 1903.

90. **Anodonta cataracta** Say.

Golden Lake, Waukesha Co.,; Maple Lake, Oneida Co.

Inasmuch as Simpson, Synopsis, p. 632, discredits the northwestern records of this species, the identification as above might be challenged. The specimens seem to be this species rather than *A. marginata* Say.

Anodonta implicata Say.

11055, "Baraboo River, Wis.," Wiswall collection. Honey Creek, Towns Greenfield and Wauwatosa, C. E. Brown, Oct., 1903, fairly common.

91. **Anodonta imbecillis** Say.

One young shell from Lake Winnebago, west of High Cliff, Calumet Co.

92. **Anodonta grandis** Say.

Milwaukee river above Lindwurm, and below Schlitz icehouse; mill pond at Wauwatosa; Fox river near Big Bend, Golden Lake and Ballad's cottage, Okauchee Lake, Waukesha Co.; Winnebago Lake at Menasha and west of High Cliff; Jambo Creek and Two Rivers, Manitowoc Co.; Maple Lake, Oneida Co.; Clem Lake, Waupaca Co., C. E. Brown, Aug., 1903, common.

Anodonta grandis footiana Lea.

11038, "Wis.," Wiswall collection.

Anodonta grandis gigantea Lea.

3480, Milwaukee, Wis., Nat. Hist. Soc., as *A. plana*.

93. **Anodontoides ferussacianus** Lea.

Milwaukee river, between Lindwurm and Schlitz icehouse; Mud Creek, east of Teutonia avenue; Root river, at Loomis road, Town Franklin; Jambo Creek, Manitowoc Co. Milwaukee river, Wis., Nat. Hist. Soc. 11032, "Lake Leota, Wis.," Wiswall collection.

94. **Symphynota compressa** Lea.

Jambo Creek, Manitowoc Co. "Wisconsin," Simpson, Syn. Naiades, p. 663.

95. **Symphynota (Lasmigona) costata** Rafinesque,

Milwaukee River at Lindwurm, and below Schlitz icehouse. Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

96. **Symphynota (Pterosygna) complanata** Barnes.

Milwaukee river, at Lindwurm and Schlitz icehouse; Two Rivers, Manitowoc Co. 11010, "Wis.," Wiswall collection.

97. **Alasmidonta (Pressodonia) calceolus** Lea.

Lake Michigan shore at Lake Park; Jambo Creek, Manitowoc Co. Beasley Creek, She-she-pe-comeo Park, Waupaca Co., C. E. Brown, Aug., 1903.

98. **Alasmidonta (Rugifera) marginata** Say.

(syn. **Alasmidonta truncata** B H. Wright.)

Milwaukee river, at Lindwurm and below Schlitz icehouse. 3473, Milwaukee river, Wis. Nat. Hist. Soc. 11046, "Wis.," Wiswall collection. Junction Lake, Waupaca Co., C. E. Brown, Aug., 1903. Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown. For the evidence that this form rather the eastern variety is the true marginata, see Fox in Naut., XV., 47.

99. **Unio (Elliptio) gibbosus** Barnes.

Milwaukee river, from Lindwurm to Schlitz icehouse, abundant; Fox river, near Big Bend, Waukesha Co.; ancient shell heaps at Winneconne, Winnebago Co.; Lake Winnebago, west of High Cliff, Calumet Co.; Two Rivers and mill pond at Hika, Manitowoc Co. 11034, 11035, "Wis.," Wiswall collection. Beasley brook, She-she-pe-comeo Park, Waupaca Co., common, C. E. Brown, Aug., 1903. Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

Unio gibbosus delicatus Simpson.

12649, Fox river, near Big Bend, Waukesha Co., C. E. Brown.

Unio (Elliptio) crassidens Lamarck.

Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown. Fossil at Green Bay, see Wagner, Naut., XVIII, 97.

Pleurobema (Plethobasus) æsopus Green.

11031, 11040, "Wis.," Wiswall collection.

Quadrula (Crenodonta) plicata Say.

"Wis.," Wiswall collection (?). Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

100. **Quadrula (Crenodonta) undulata** Barnes.

Fox river, near Big Bend, Waukesha Co.; ancient shell heaps at Winneconne, Winnebago Co.; Two Rivers, Manitowoc Co.; Clear Water Lake Creek, Oneida Co. 12650, Fox river, near Big Bend, C. E. Brown. Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

Quadrula (Crenodonta) heros Say.

Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

Quadrula metanevra Rafinesque.

11013 seq., "Wis.," Wiswall collection.

Quadrula (Theliderma) fragosa Conrad.

11009, "Wisconsin River," Wiswall collection.

101. **Quadrula (Theliderma) pustulosa** Lea.

Ancient shell heaps at Winneconne, Winnebago Co. 11018, "Wis.," Wiswall collection. Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

102. **Quadrula (Fusconala) rubiginosa** Lea.

Milwaukee river, Lindwurm to Schlitz icehouse, abundant; Mud Creek, east of Teutonia avenue, fragment of a young shell; Menomonee river dredgings; Two Rivers, Manitowoc Co.; Clear Water Lake Creek, Oneida Co. 3413, Milwaukee river, Wis. Nat. Hist. Soc. 11001, "Wis.," Wiswall collection.

103. **Quadrula (Fusconaia) trigona** Lea.

Doubtfully from Milwaukee river above Lindwurm. 10698, Sugar river at Brodhead, H. H. Hayssen. 11006, "Wis.," Wiswall collection.

Quadrula (Fusconaia) coccinea Conrad.

11041, "Wis.," Wiswall collection. A fragment from the ancient shell heaps at Winneconne probably belongs to this species.

Quadrula (Fusconaia) solida Lea.

11047, 11049, "Wis.," Wiswall collection. "Wisconsin," Simpson, Syn. Naiades, p. 789.

Quadrula (Fusconaia) pyramidata Lea

"North in the Mississippi to Wisconsin," Simpson, Syn. Naiades, p. 790.

Quadrula (Fusconaia) kirtlandiana Lea.

"North to Wisconsin?," Simpson, Synopsis, p. 791.

Quadrula (Fusconaia) ebena Lea.

11004, "Wis.," Wiswall collection. Between Prairie du Chien and De Soto, Bunde & Upmeyer collection, C. E. Brown.

Quadrula (Rotundaria) tuberculata Rafinesque.

10689, Sugar river at Brodhead, Green Co., H. H. Hayssen. 11027, 11028, "Wis.," Wiswall collection.

104. **Sphærium vermontanum** Prime.

Sandy beach of Lake Michigan at Milwaukee; north shore of Lake Winnebago, one-half mile west of High Cliff, Calumet Co. This is a species of the larger lakes, which has been confused with S. solidulum; see Mollusca of the Chicago Area, p. 394. The identification is still open to some question according to Dr. Sterki.

Sphærium solidulum Prime.

Kenosha, Mrs. E. C. Wiswall's list. "Wisconsin," Prime, Smith. Misc. Coll., VII, 36. These citations may be in error for the preceding species.

105, **Sphærium rhomboideum** Say.

Mud Creek east of Teutonia avenue bridge, and Honey Creek near Layton Park; abundant at both localities. Occurs with *S. simile.*

106. **Sphærium stamineum** Conrad.

North bank of Milwaukee river at Lindwurm; Mud Creek, half a mile east of Teutonia avenue; Kinnickinnic river near Eleventh avenue.

107. **Sphærium striatinum** Lamarck.

Very abundant in Mud Creek, on a gravelly bottom, half a mile east of Teutonia avenue, with the preceding and following; dead shells at the cement mills, Lindwurm. "Wisconsin," Prime, Smith. Misc. Coll., VII, 37.

108. **Sphærium simile** Say.

Sandy beach of Lake Michigan at Milwaukee; Mud Creek, from North Milwaukee to half a mile east of Teutonia avenue, locally abundant; Honey Creek, near Layton Park, common (also in 1903, "very common," C. E. Brown); fossil at Cold Spring Park; Lake Winnebago, near High Cliff; Calumet Co., East Twin River at Two Rivers, and Molas Creek, Manitowoc Co. Kenosha (as *Sphœrium sulcatum* Lamarck), Mrs. Wiswall's list. "Wisconsin" (as *S. sulcatum*), Prime, Smith. Misc. Coll., VII. 34. Widely distributed.

109. **Sphærium fabale** Prime.

Honey Creek, near Layton Park.

Sphærium occidentale Prime.

Kenosha (?) (as "*Pisidium occidentale*"), Mrs. Wiswall's list. Overflow pond of Milwaukee river at Lindwurm, C. E. Brown, July, 1903. "Wisconsin," Prime, Smith. Misc. Coll., VII, 41.

110. **Calyculina transversa** Say.

Mud Creek, half mile east of Teutonia avenue.

111. **Calyculina truncata** Linsley.

Common in Mud Creek east of Teutonia avenue bridge; abundant in a pool in Johnson's woods; Honey Creek, near Layton Park. "Wisconsin," Prime, Smith. Misc. Coll., VII, 51,—to which Dr. Lapham has added in pencil, in the public library copy: "Minnesota—not Wisconsin. I. A. L."

Calyculina jayensis Prime.

Kenosha (?) (as "*Sphœrium jayanum* Prime"), Mrs. Wiswall's list. "Wisconsin," Sterki in Naut. XVI, 92.

Calyculina partumeia Say.

Kenosha, Mrs. Wiswall's list. "Wisconsin," Prime, Smith. Misc. Coll., VII, 45.

Pisidium abyssorum (Stimpson) Sterki.

"Racine, Wis., Geo. T. Marston," and "Green Lake, Wis., Bryant Walker," Nautilus, XI, 125, species described.

112. **Pisidium compressum** Prime.

Mud Creek at North Milwaukee, identified by Dr. Sterki.

Pisidium fallax Sterki.

"Wisconsin," Baker, Moll. Chic. Area, p. 401.

Pisidium medianum Sterki.

"Lakes in Wisconsin," Naut., XIII, 11, species described.

113. **Pisidium noveboracense** Prime.

Mud Creek at North Milwaukee, identified by Dr. Sterki.

Pisidium pauperculum Sterki.

"Fox River, Wisconsin. Geo. T. Marston," Naut., X, 65, species described.

114. **Pisidium sargenti** ? Sterki.

Mud Creek at North Milwaukee; identified with doubt by Dr. Sterki.

Pisidium virginicum Gmelin.

"Wisconsin," Prime, Smith. Misc. Coll., VII, 62.

115. **Pisidium walkeri** Sterki.

Mud Creek at North Milwaukee, identified by Dr. Sterki. Described, Naut., IX, 75.

Dr. V. Sterki has kindly examined all the Sphæria and Pisidia, correcting the hasty identifications of the former made by Mr. Baker and myself, and identifying such of the latter as were in suitable condition. Material not yet identified has been secured from the following additional localities:

Sphærium: Lake Michigan beach, from pumping stations to Lake Park; Mud Creek at North Milwaukee; Menomonee river dredgings; Honey Creek.

Calyculina: Pond in Cabeen's woods, Chicago avenue.

Pisidium: Mud Creek valley at North Milwaukee and eastward; artificial pond near Kraatz's brickyard; Lake Winnebago, west of High Cliff, Calumet Co. Dr. Sterki thinks the latter may be an undescribed form.

These localities should be systematically canvassed in the spring for fuller suites of living specimens.

TWO NEW SPECIES OF PHORIDÆ.

BY CHARLES T. BRUES.

APHIOCHÆTA LONGIFRONS, sp. nov.

Male. Length 2 mm. Brownish-yellow; dorsum just before scutellum, tips of posterior femora, and most of abdominal segments, 2, 3, 4 and 6, black. Wings infuscated on apical third.

Head long and much flattened; front about two and one-half times as high as wide, rather sharply margined on the vertex, the ocelli not situated on a tubercle, but the median frontal line is distinct. Front brownish-yellow, blackened about the ocelli, subshining, but with a sparse and very coarse punctuation. Two proclinate bristles; next two rows above these consisting each of only two bristles, the median pair of each row being absent. The lower pair are placed midway between the median line and the eye, and the upper pair close to the eye margin. Third row and ocellar row complete, the third strongly bowed upward. Antennæ rather small, yellow, with long pubescent arista. Palpi pale testaceous, with normal bristles, short and broad in shape. Cheeks each with a series of long bristles and one especially stout macrochæta at the lower end of the eye. Thoracic dorsum light yellow, with a medium brownish vitta, posterior one-third blackish, with unusually strong and bristly hairs posteriorly. One pair of dorsocentral machrochætæ present. Scutellum whitish yellow, black at base; with four equally strong marginal bristles. Pleuræ pale, with a black stripe extending from the dorsum one-half way to the trochanters. Abdomen testaceous yellow; the second segment black posteriorly and widely so on the sides; third and fourth segments black, with yellow semi-circular markings anteriorly, fifth pale, sixth black. Venter pale. Hypopygium small, with four somewhat bristly hairs near the base of the long slender lamella. Legs very stout, testaceous, the tips of the posterior femora black, and the posterior tibiæ and tarsi lined with black. Four posterior tibiæ biseriately setulose, the setulæ large, almost equalling the width of the tibia on the hind legs, and on the middle legs fully as long as the greatest width of the middle tibia. Anterior tibiæ also with a single series of short and very closely placed setulæ. Tarsi of four posterior legs long and slender, those of the front legs no longer than the tibia, with thick, short joints, the third, fourth and fifth being nearly quadrate. Wings long and narrow, hyaline, distinctly infuscated on apical third, the discal veins but little curved. Costal vein reaching to the middle of the wing, its cilia short, dense and closely placed. First vein ending a trifle closer to the tip of the third than to the humeral cross-vein. Third vein close to the costa, the cell at its furcation very narrow. Fourth vein faintly curved at base and recurved at tip, fifth and sixth but little curved, seventh very distinct. Halteres pale.

Described from one male specimen collected hovering about the burrows of *Tremex columba* in an old stump where *Thalessa lunator* and *T. atrata* were ovipositing. Milwaukee, Wisconsin, June 8, 1906. Type in the collection of the Milwaukee Public Museum.

Since writing the above, I have received an exactly similar male sent for identification by Mr. E. S. Tucker of the University of Kansas. It is labeled, twilight, Lawrence, Kans., June.

This is a very distinct species, easily recognized by its infuscated wings, long front and very spiny legs. The shape and peculiar chætotaxy of the front are similar to *A. epeiræ* Brues, but it is quite different in other characters, notably the non-thickened costal vein, and the presence of four scutellar bristles.

APHIOCHÆTA CAVERNICOLA sp. nov.

Male and Female. Length 2-2.5 mm. Black or piceous; legs, antennæ and palpi yellow. Head wide and short; the front fully twice as wide as high, sub-shining. Four proclinate bristles present, very long and stout and more nearly porrect than is usual in this genus. Following two rows slightly curved downward; ocellar row normal. Ocelli placed on a tubercle, the median frontal line present. Antennal cavity large and deep; the antennæ brownish-yellow, ovate, of moderate size; arista long, pubescent. Palpi large and rather slender, with the usual bristles; proboscis retracted. Cheeks each with a row of stout macrochætæ along the lower eye-margin; post-ocular cilia very long. Thoracic dorsum piceous, finely hairy and sub-shining, with no conspicuous bristles except a single pair of dorsocentral macrochætæ and a bristle on each side before the wing. Scutellum subtriangular, with only two marginal bristles. Abdomen long and narrow, black, subopaque, slightly shining in the female. Bare, except for a few short scattered hairs in the male. Male hypopygium small, the small lamella triangular and scarcely projecting. Legs long and slender; testaceous yellow. Tibiæ bare except for the slightest trace of ciliation on the posterior pair. Wings very large, tinged with brownish. Costal vein reaching a little beyond the middle of the wing, its cilia moderately long and rather thickly placed. First vein ending midway between the humeral cross-vein and tip of third vein. Furcation of third vein not very acute, the cell formed of moderate size. Fourth vein strongly curved basally and straight apically, ending closer to the wing tip than the fifth. Fifth and sixth sinuate. Seventh distinct. Halteres pale yellow.

Described from four specimens representing both sexes, two collected in Wyandotte Cave, Indiana, received from Prof. J. M. Aldrich, and two others recently sent me by Prof. C. F. Adams, who writes me that they were collected by Mr. A. M. Banta in Mayfields Cave, near Bloomington, Ind. Types in the collection of the Milwaukee Public Museum.

Until recently I have considered this species to be only an extreme type of the variable *A. nigriceps* Loew, but a more careful examination leads me to believe that they are perfectly distinct. The front is much wider than in *nigriceps,* the legs are longer and more slender, and the palpi of the male are not at all enlarged. The hypopygial lamella is also much smaller.

This is the only true cavernicolous form so far to be discovered in North America, and has previously been referred to several times. In the American Entomologist for 1880, Hubbard mentions the occurrence of larva belonging to a species of *Phora* found feeding on offal in Washington Hall, Mammoth Cave, Ky. He describes the larva and pupa, but gives no specific name to the species. Packard in his Cave Fauna (1) quotes Hubbard's observations, but gives nothing further. In 1896 Aldrich (2) recorded as *A. nigriceps* Lw., what were presumably specimens from the lot here described from Wyandotte Cave, with the following note by Blatchley: "Taken from the mouldy remains of bread, chickens, etc., near the 'Augur Hole,' three-fourths of a mile from the mouth."

This is the second cavernicolous Phorid to be described, the European *Phora aptina* being also an inhabitant of caves. This latter species was found in the Adelsberg Grotto in Carniola, (3) and has been recently recorded by Bezzi (4) from the Covolo di Costozza near Venice in Italy. Bezzi considers the European species to be exclusively cavernicolous in occurrence, and the same is probably true of the American one here described.

Public Museum, Milwaukee, June 15, 1906.

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(1) Mem. Nat. Acad. Sci., IV., p. 81 (1886).

(2) On a Collection of Diptera from Indiana Caves, Rept. Indiana State Geologist for 1896.

(3) [Schiner, Fauna d. Adelsberg Grotte (1853)].

(4) [Rivista Italiana di Speleologia, I, fasc. II (1903), p. 13].

DESCRIPTIONS OF PARASITIC HYMENOPTERA FROM CAPE COLONY.

BY CHARLES T. BRUES.

The species described in the present paper have recently been acquired by the Milwaukee Public Museum through the kindness of Dr. Hans Brauns of Willomore, Cape Colony. As the smaller parasitic Hymenoptera of this region are still practically unknown, it is not surprising that nearly all the species proved to be undescribed.

The types are deposited in the Milwaukee Public Museum.

FAMILY BETHYLIDÆ.

MYSTROCNEMIS CAPENSIS sp. nov.

Length 7 mm. Black; thorax, antennæ, tibiæ and tarsi rufous. Head seen from above, a little longer than wide, suddenly narrowed just before the eyes, and rounded-truncate on the anterior margin, overhanging the insertion of the antennæ. Antennæ 27-jointed, setaceous; scape stout, two times as long as broad, following joints all of about equal length, gradually narrowing, the last a trifle longer. First few flagellar joints nearly twice as wide as long. Eyes hairy. Pronotum about two and one-half times as long as wide, arcuately incised posteriorly; with a median impressed line. Mesonotum very small, subtriangular, the scutellum about twice as large, rounded and convex; metanotum nearly as long as the prontum, and considerably wider, obtusely pointed behind. Abdomen composed of five segments of nearly equal length, the sides subparallel; tip pointed. Legs stout. Anterior femora a little more than two times as long as wide, ovate in shape; the anterior tibiæ shaped like the femora, but only two-fifths as long. Anterior tarsi stout, the tarsal claws stout and strong, bidentate at tip. Claws of four posterior tarsi very slender, with a rather obtuse tooth beneath near the tip. Entire body sub-shining, covered with a short whitish pubescence.

Described from one female from Sunday River, Capland (O'Neil). This is the third species of this recently discovered genus to be described.

The type species was described by Kieffer in 1905 from

Burma,* and a second one by the same writer previously from Portuguese Guinea.** The present one is very similar to the other two, differing principally by its 27-jointed antennæ.

GONATOPUS PILOSIPES sp. nov. (PL. 1, FIG. 1.)

Female. Length 7 mm. Black, part of face and extreme tip of abdomen reddish or yellowish; everywhere clothed with long, thin, whitish hairs absent only on the antennæ. Head strongly concave about the antennæ and behind; shagreened, with a few indications of longitudinal striations near the ocelli, and with a few large punctures on the sides of the occiput. Face above the base of the antennæ smooth and highly polished, with a raised line extending from the base of the antennæ to the anterior ocellus. Lower half of the face on the sides with a stripe of dense white pubescence under which the ground color is pale. Clypeus yellow, the center blackened, the margin rounded-truncate with a fringe of yellowish hairs. Mandibles 3-dentate, pale basally. Palpi pale. Antennæ 10-jointed; scape and pedicel brown, the former pale beneath. Scape three times as long as thick, twice as long as the pedicel and half as long as the first flagellar joint, the following growing shorter so that the fourth flagellar is as long as the scape. Antennæ slender and of nearly equal width throughout, slightly longer than the thorax. Eyes bare. Thorax elongate, the stalk at the base of the posterior lobe longer than usual; pronotum with the transverse depression distinct but not very deep; shining throughout, except for oblique aciculations laterally behind; the lower front angles and a spot in the middle posteriorly, rufous. Posterior lobe tarnsversely aciculated behind and on the sides; longitudinally so in front above. At the base of the stalk with a small sharp tooth on each side. No meso-metanotal suture evident. Abdomen shining black, the extreme tip rufous. Legs shining black, the anterior knees and chelar claw reddish; anterior trochanters very narrow at the base, their femora stout, obclavate, very shining; tibiæ thickened except at base. Fourth tarsal joint a little shorter than the first, second and third together one-half as long as the first, the third nearly two times as long as the second; chelar claw but little curved, simple, not dentate; the fixed claw reaching to the base of the third joint with a small circular pad of lamellar hairs at tip. Posterior legs rather long and slender, the femora swollen only very close to their base, sparsely clothed with long hairs, those on the tibiæ about twice as long as the thickness of the tibiæ.

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* Ann. Soc. Sci. Bruxelles, Vol. 29, pt. 2, p. 110.

** (Ann. Mus. Civ. Genoa, Ser. 3, Vol. 1, p. 363 (1904)).

One female, Bothaville, Orange Free State, October 12, 1898 (Dr. Hans. Brauns).

This species is noticeable on account of its pilose body, resembling in this respect *G. cilipes* Kieffer from Paraguay.

GONATOPUS CAPENSIS sp. nov.

Female, Length 6 mm. Black, base of antennæ and clypeus pale; legs varied with rufous. Head strongly concave above the eyes and behind; finely shagreened, with indications on the front of microscopic longitudinal striations. Subopaque, with a raised median line extending from the base of the antennæ to the front ocellus. Eyes bare. Clypeus pale, with darker center; white pilose, with a yellow fringe anteriorly; front margin evenly arcuate. Mandibles pale, with three black teeth. Palpi pale. Anterior orbits below and cheeks pale, the former slightly whitish hairy near the lower corner of the eyes. Antennæ black, slender, reaching to the middle of the propodeum. First two joints brown, the scape pale yellow beneath, and clothed with long white pubescence. Scape one and one-half times as long as the pedicel and less than one-half as long as the first flagellar joint, following joints smaller, fifth flagellar as long as the scape. Thorax slender, the posterior lobe with a long stalk at its base, laterally toothed just behind the stalk. Anteriorly lobe microscopically punctate, sub-shining with an æneous cast. Transverse impression well marked, but not very deep, with a few transverse aciculations just behind it. Propleuræ punctured. Posterior lobe with an indication of a meso-metanotal suture, transversely aciculated behind and more finely so below, longitudinally aciculated medially in front. Abdomen shining black, not pilose. Legs moderately long, clothed with a few microscopic white hairs; anterior trochanters remarkably long and very slender, especially at the base. Front femora swollen as usual, their tibiæ very stout, except at base. Fourth tarsal joint as long as the three basal ones together, the second and third equal, together two-thirds as long as the first. Claw long and slender, curved at the tip, reaching to the tip of the first tarsal joint. Posterior legs slender, their femora swollen only at the very base.

Described from one female from Willomore, Cape Colony, Dr. Brauns.

This species resembles the preceding in size and habitus, but differs by its non-pilose body as well as by its differently formed legs and antennæ.

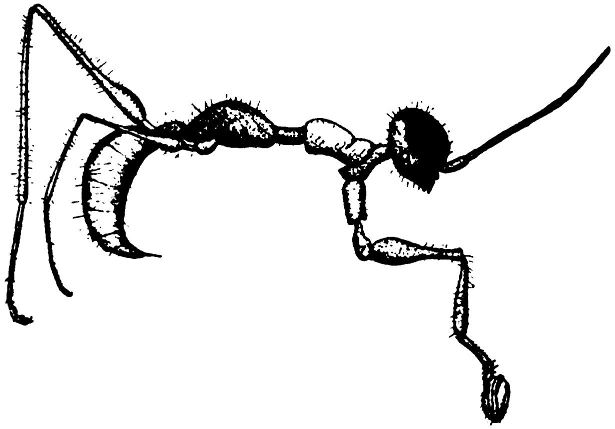
GONATOPUS VARIPES sp. nov.

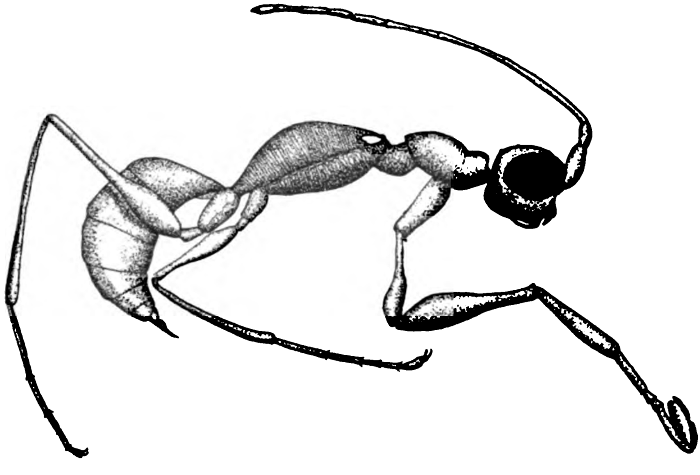
Female. Length 3 mm. Shining black; the legs, except swollen parts of anterior femora and first two or three joints of antennæ yellowish or brownish. Head flatter than usual, broadly concave above the antennæ and deeply excavated on the vertex. Front highly polished, smooth except for a faint shagreened sculpture on the vertex and occiput. Front with a median line below the front ocellus to the base of the antennæ. Face just above the antennæ whitish pilose and microscopically transversely rugulose. Clypeus pale yellow, rounded in front. Mandibles whitish, with four dark teeth. Palpi pale. Antennæ rather stout and short, barely as long as the thorax; black, the scape and pedicel yellow and the first flagellar joint dark yellow with brown tip. Scape short, but strongly arcuate, pedicel three-fourths the length of the scape and a little more than half the length of the first flagellar joint; second flagellar joint two-thirds the length of the first, others slowly decreasing; last a little longer than the penultimate. Eyes bare. Thorax highly shining, microscopically shagreened, especially on the sides. Metathorax behind more coarsely shagreened or microscopically rugulose, but not aciculated. Pronotum without the transverse impression except a slight one very close to the anterior border. Anterior neck of posterior lobe irregularly longitudinally sculptured, the metathorax with no lateral tooth-like projections at the base. Abdomen very short and broad, clothed with a few long, thin, white hairs; black, the surface shining. Legs beset with a few long pale hairs; pale brownish-yellow, coxæ included; the basal two-thirds of the anterior femora black, and the four posterior tibiæ tipped with darker brown. The femora are all rather short and thickened on almost the entire basal half. First and fourth joints of anterior tarsi about equal, the second two-thirds the length of the third, the two together equal to the fourth. Chelar claw slender, curved toward the tip; chela reaching nearly to the base of second joint. Anterior trochanters with a short basal stalk.

One specimen received from Dr. Brauns, labelled Salisbury, Mashonaland, G. A. K. Marshall.

This is a pretty shining species, with conspicuously bicolored legs.

PLATE I.





EXPLANATION OF PLATE:

Fig. 1. Gonatopus pilosipes sp. nov. Female.
Fig. 2. Gynochelys braunsi gen. et sp. nov. Female.

GONATOPUS SIMILIS sp. nov.

Female. Length 3 mm. Brownish-yellow, the head darkened on the front; the abdomen piceous and the antennæ black, except base and tip. Head deeply excavated behind, and above the antennæ; brownish-yellow, blackened above the ocelli. Front with a median raised line from the anterior ocellus to the base of the antennæ; smooth and shining, shagreened toward the vertex, on the occiput, and on the sides of the face below. Lower orbits not hairy or pubescent. Clypeus strongly and evenly rounded anteriorly. Maudibles 4-dentate. Eyes bare; antennæ short, but not thickened, the scape slender, arcuate, one and one-half times the length of the pedicel; first flagellar joint about the length of the scape; second equal to the pedicel; following joints about two times as long as thick, gradually shortening except the last which is nearly twice the length of the penultimate. Scape and pedicel yellow, flagellar joints one to six black, seven piceous and eight yellow. Thorax bilobed, yellowish-brown. The prothorax with a transverse impression just before the middle and a narrow raised anterior margin. Pronotum finely microscopically punctured in front and shagreened behind the impression. Stalk of posterior lobe short; metathorax shining centrally, microscopically rugulose anteriorly and irregularly transversely aciculated posteriorly; not toothed at the sides anteriorly. Abdomen short, sub-triangular; piceous black, shining, clothed with short sparse pale hairs. Legs rather short, pale yellow, the swollen portions of the anterior femora and tibiæ brownish. Anterior trochanters long, with a rather long stalk-like basal portion. Femora swollen on almost the entire basal half. First joint of anterior tarsus a trifle longer than the fourth. Second and third about equal, together two-thirds the length of the fourth. Chelar claw slender, curved only at the tip; tip of chela reaching to the base of the third joint.

One specimen from Algoa Bay, Capland, May 25, 1898. Dr. Brauns.

This species resembles the preceding rather closely except in color. The flagellum of the antennæ is not so slender basally, however, the apical joint is longer, and the thoracic sculpture somewhat different. The body and legs also lack the whitish hairs which are conspicuous in *G. varipes.*

Both forms are exceedingly ant-like, and strongly recall species of the cosmopolitan myrmicine genus *Pheidole.*

GYNOCHELYS gen. nov.

Similar in general appearance to *Gonatopus,* but with the head subquadrate and front convex as in *Dryinus* and its allies or in *Chelogynus.* Antennæ with the first, second and third flagellar joints extremely elongated. Thorax distinctly bilobed as in *Gonatopus,* but with the mesonotum and scutellum differentiated although small. Wings present as vestiges in the form of small membranous pads. Meso and metapleuræ distinctly separated by a suture. Abdomen and legs as in *Gonatopus.*

The present form seems to differ quite radically from anything that has so far been described, and I think it worthy of generic rank in spite of our present very meagre knowledge of the Dryininæ. It does not seem to be similar to any of the numerous and very closely allied genera recently proposed by Perkins** to include the forms placed by other writers in *Gonatopus, Dryinus, Chelogynus,* etc. In Perkins' table (*l. c.*) it would fall into his genus *Eukœbeleia** on account of its vestigial wings. The latter has, however, the ordinary thoracic structure of the winged forms, while in *Gynochelys,* the thorax is profoundly modified and approaches the anomalous condition seen in *Gonatopus.*

GYNOCHELYS BRAUNSI sp. nov. (PL. 1, FIG. 2.)

Female. Length 5 mm. General color piceous, head black, legs and antennæ varied with paler brown; clypeus and mouth parts rufous; mesonotum and scutellum pale rufous. Head two and one-half times as wide as long, the temples obliquely truncated, vertex between the eyes rounded, gently convex; front also convex, or when seen from above, straight. Antennæ inserted at the base of the clypeus, very slender, as long as the head and thorax together. Scape short and stout, strongly curved; pedicel slender, half the length of the scape; first flagellar joint slender, almost twice as long as the scape and pedicel together, and three-fourths as long as the greatest width of the head; second and third joints decreasing, the third two-thirds the length of the first; the apical four joints shorter and equal. Mandibles slender, the outer tooth very acute. Palpi short. Front microscopically rugulose, with a raised median line. Ocelli small, placed in a small triangle, the vertex slightly margined just behind them.

** (Bull. No. 1, Sugar Planters' Experiment Station, Hawaii (1905)).

* *Eukœbeleia* is preoccupied by Ashmead's *Eukœbelea,* Proc. Wash. Ent. Soc., VI, p. 126 (1904), a genus of Chalcidoidea; but never having seen Perkins' species I would hesitate to propose another name.

Eyes large, bare. Cheeks large, nearly smooth. Thorax binodose, the posterior node the longer. Pronotum with a very deep transverse impression just in front of the middle; shagreened. Mesonotum distinct, but very small, scarcely one-fourth the width of the pronotum, and about as long as wide, narrowed behind. Tegulæ present, rufous. Wings as long as the mesonotum, whitish and without apparent venation. Scutellum convex, about one-half as long and narrower than the mesonotum. Posterior thoracic lobe consisting of the mesopleuræ and the metathorax, distinctly separated by a suture which extends obliquely along the side of the entire node. The metathorax is very coarsely transversely strigose, opaque, the metapleuræ and under side of the lobe more irregularly strigose. Abdomen ovate, pointed, consisting of seven distinct dorsal segments; the first segment rather strongly petioliform; surface shining, not hairy. Legs long, rufous or brownish, the anterior trochanters three-fourths as long as their femora, with a long narrow basal stalk which is longer than the swollen apical portion. First and fourth tarsal joints nearly equal, the second and third together one-half as long, equal. Chelar claw straight, strongly bent at the tip. The chela with the usual squamules rather sparsely placed. Middle femora thick, more strongly so on basal one-half. Posterior pair slender, swollen on basal half. Tibiæ and tarsi slender.

One female from Algoa Bay, Capland, Dr. Brauns.

I take great pleasure in dedicating this remarkable species to my friend and colleague, Dr. Hans Brauns of Willomore, through whose zeal and kindness I have been enabled to study the present interesting collection.

FAMILY SCELIONIDÆ.

SCELIO PULCHRIPENNIS sp. nov.

Female. Length 3.5-4 mm. Black, rugose, whitish, hairy; tarsi brownish; wings fuscous, spotted with white. Head flattened, seen from above a little over two times as wide as thick; the surface reticulate rugose, tending to form irregular oblique striæ about the base of the antennæ. Antennæ 11-jointed, the flagellum one and one-half times the length of the scape; pedicel as long as the first two flagellar joints; second and third submoniliform, equal, each two-thirds as long as the first; club 7-jointed, the joints of nearly equal length, somewhat over twice as wide as long. Mandibles rufopiceous. Mesonotum and scutellum longitudinally rugose, sub-shining, no trace of parapsidal furrows. Metathorax finely reticulate. Abdomen as long as the head and thorax together, entire dorsum longitudinally aciculate; segments three and four each one-half longer than the second. Venter more or less rufous. Pleuræ rugose, the mesopleural piece more or less striated. Legs black, the four anterior tibiæ and the tarsi, rufous. Wings reaching almost to the tip of the abdomen; the submarginal vein visible only at the middle; stigma subobsolete or not developed, no stigmal vein. Basal half of wing hyaline, with a semi-circular hyaline spot on the anterior margin, half way between the stigma and the wing tip, also sometimes a less evident spot posteriorly nearer the wing tip. Hind wings hyaline.

Five female specimens, Algoa Bay, Capland, January 22, November 29 and December 11, 1896 (Dr. Brauns).

This species is a typical *Scelio*, rather remarkable on account of its pictured wings, in which character it resembles the following species.

SCELIO NITENS sp. nov.

Female. Length 3.75-4.25 mm. Shining, bluish black, everywhere sparsely pale hairy. Anterior legs pale rufous. Wings marked with fuscous. Head scarcely twice as wide as thick; surface polished on the vertex, with a few scattered punctures; central part of face and cheeks rugulose, more or less striate at the base of the antennæ. Mandibles rufous. Antennæ black, the tip of the pedicel yellowish. Flagellum one and one-half times as long as the scape. Pedicel as long as the first and second joints of the flagellum together, the second two-thirds as long as the first. Third and following enlarging to the club which is indistinctly 7-jointed, equal; the club joints two and one-half times as wide as long, the last triangular. Collar, mesonotum, and scutellum polished blue-black, with a few scattered punctures; the scutellum with a submarginal groove and a raised margin. Parapsidal furrows wanting. Metanotum longitudinally rugose, gradually sloping to the petiole. Abdomen shining, the dorsal surface longitudinally aciculate, more weakly so toward tip; third and fourth segments subequal, fifth and second subequal, each two-thirds the length of the third. Anterior legs, including coxæ, yellowish brown, the femora darker above; middle legs, including coxæ fuscous; posterior coxæ and femora piceous, tibiæ and tarsi rufous. Pleuræ finely rugose, the mesopleural piece smooth and polished, except for several striæ below. Wings reaching to the tip of the fourth abdominal segment. Wings fuscous; the basal half hyaline with a fuscous band; and the apical half with two more or less distinct hyaline spots, one anterior and one posterior. Submarginal vein distinct on the basal half. Stigma well-developed ,piceous, drawn out into a point where the stigmal vein should be, the latter absent. Hind wings hyaline.

This species resembles the preceding on account of its similarly marked wings. The vertex, mesonotum and scutellum are smooth and polished, however. The legs are also lighter in color, and the wings have a well developed stigma.

Described from 6 female specimens, five from Algoa Bay, November 29 and February 6, 1896, and one from Uitenhage, Capland, October 16, 1896. All were collected by Dr. Brauns.

FAMILY ENCYRTIDÆ.

METAPELMA MIRABILIS sp. nov.

Female. Length 9 mm, including ovipositor which is almost as long as the abdomen. Head and thorax greenish æneous, the abdomen black, with greenish and purplish reflections. Legs piceous or black, the base of the posterior tibiæ white. Body covered everywhere with a dense, short, whitish pubescence. Head with coarse scattered punctures, the surface strongly shagreened; blackish on the front and very green below and behind. Mandibles fuscous with black tips; palpi black. Antennæ black, the scape strongly widened toward the tip; pedicel two times as long as the first flagellar joint; second nearly as long as the scape; wollowing distinctly shorter, except the last, nearly quadrate but not moniliform; last pointed, being obliquely and sharply truncated. Eyes strongly hairy. Pronotum and mesonotum shining green, with purplish reflections; very faintly shagreened, almost smooth. Axillæ and scutellums purplish black, the former with their points meeting medially. Metathorax short, depressed, abdomen gradually narrowed from the tip of the first segment to the ovipostor which is almost as long as the adbomen. First segment very long, second, third and fourth equal, each two-thirds the length of the first; all entire on the apical margin. Fifth, sixth and seventh segments narrower and very short. Ovipositor apical, very slender and knife-like, black with greenish reflections. Venter black, with faint reflections. Coxæ and anterior femora greenish, anterior tibiæ and tarsi brownish; middle legs piceous, the tibiæ lighter at tip, their spur three-fourths of the length of the first tarsal joint. Hind legs black, the extreme base of the tibiæ black. Hind tibiæ very broad, and strongly flattened, cleaver-shaped, fully one-third as wide as long, the leaf-like part two times as wide as the thickened part; at the tip with two small apical spurs. Hind tarsi flattened, but scarcely over one-fourth as wide as the tibiæ. Metatarsus as long as the three following joints which gradually become narrower. Wings hyaline, tinged with brown behind the stigma; marginal and postmarginal veins equal, each two and one-half times as long as the knobbed stigmal vein.

Male. Length 5 mm. Much more slender, the legs very long. Apical joint of antennæ wider than the penultimate, ovate pointed, but scarcely obliquely truncate. Middle tibiæ much longer, their spur one and one-fourth times the length of the first tarsal joint. Hind tibiæ flattened, but not broader than the femora. Tarsi only slightly flattened. Wings without the stigmal spot. Otherwise similar to the female.

Described from two specimens, the female from Algoa Bay, Capland, Dec. 29, 1895, and the male from the same locality Nov. 11, 1905. Both were collected by Dr. Brauns.

This remarkable species is very similar to the North American *Metapelma specabilis* of Westwood,* but differs by its much more strongly compressed hind tibiæ, smoother thoracic dorsum and differently colored legs. I have had opportunity to compare the two through the kindness of Dr. Wm. H. Ashmead, who loaned me a specimen of Westwood's species.

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*[Proc. Zool. Soc. London, Vol. 3, p. 69 (1835)].

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NOTES OF THE HERRING GULL AND THE CASPIAN TERN.

(*Larus argentatus* and *Sterna caspia*).

By Henry L. Ward.

The Herring Gull is a permanent resident of Wisconsin, but not of the Milwaukee region. It comes to us from its northern breeding ground about the first of October and stays until the latter part of May.

To the urbanite it is particularly in evidence during the depths of severe winters, when the inhospitable ice fields of the lake force it to seek the rivers and basins that are kept open by passing vessels. From the down town bridges we acquire an intimate acquaintance with so much of its economy as has to do with its search for food under these artificial surroundings and in such unusual proximity to man. Normally this gull is a wary bird, seeming to appreciate the dangers of a close approach to that most destructive creature, man, and to have a fair idea of the range of a gun; but when the frozen lake forces it to seek food and shelter elsewhere its actions indicate that it is well aware that when between the factory lined docks of the river no gun will be raised against it. It is a cause for admiration to notice how quickly not only the gulls but hundreds of wild ducks, principally Old Squaws, Lesser Scaups and King Eiders, accustom themselves under the stress of hunger to this extraordinary proximity to man. When within twenty-five yards of a bridge constantly thronged with foot passengers and carrying a continuous procession of wagons, automobiles and clanging electric cars, these birds are much more at ease than they would be in open water with a man on the shore two hundred yards distant.

The first of July, 1905, a collecting expedition for the Public Museum of Milwaukee, consisting of Messrs. Brues, Shrosbree and myself, going north along the Lake Michigan shore of the Door County peninsula, arrived at Gravel Island, where we found a large breeding colony of Herring Gulls and Caspian Terns. But little could be observed of the habits of either of these birds, as we had not come prepared for such work; so after photographing nests and young and making such notes as were possible, we collected the specimens we required to produce a museum group that would do justice to the colony, and then continued our cruise to Washington Island and down the Green Bay shore of the peninsula. At Washington and Plum Islands we were told of another large colony of gulls at Gull Island, Mich., and, coming down the Green Bay shore, we found small colonies of Herring Gulls breeding on the Strawberry group.

At Sister Islands there were many gulls and terns, but none breeding, nor did we see any sign of terns nesting anywhere except at Gravel Island. The number of gulls was greatly in excess of what might be expected from the Strawberry colonies, and therefore we presumed that both species had come from the Gravel Island colony to feed. That these birds cover even greater distances in feeding was shown by the regular appearance of gulls and terns off Jacksonport, about twenty-two miles to the south, where we had seen them during some days' residence, and between which place and Gravel Island, as we came up the coast, we had noticed them flying. Between Newport and Europe Bay we frequently noticed the predilection of the gulls to fly over the woods rather than over the water, as though seeking terrestrial food; but I never saw them obtain any. Harting writes: "We have repeatedly seen Herring Gulls following the plough and seizing worms and larvæ from the newly turned soil. It is reported also that this bird feeds on grain." The same habits have been noted in this country.

In July of this year, Mr. Shrosbree and myself returned to Newport, from whence as a base we intended to make a detailed study of the Gravel Island colony. A serious accident to my companion compelled his return to Milwaukee after the first day, leaving me without competent or reliable assistance, and the news of a great personal bereavement reaching me a few days later caused me to abandon the work which had shown promise of very interesting results. Forty-three good photographs were secured, which afforded exact data for mounting the gulls in the Museum's group, and so the main object of the trip was accomplished.

I shall probably be unable to continue the observations another season, as they will then have no direct relation to the museum work in hand, therefore, with a full appreciation of the insufficiency of my observations, I present them for what they are worth.

Our first view this year of the colony caused much disappointment, as it showed that the partnership in the island that existed in 1905 between the terns and gulls had been severed, and that only the gulls were present. It was also apparent that the season was farther advanced than last year, and that there was little opportunity of observing some of the younger stages.

The absence of the terns may, perhaps, be accounted for by our shooting a number of birds the preceding year. Of their habit in this matter Morris says: "* * * yet it has been remarked that when they are once disturbed they do not easily return to their nest, and are said even not to re-visit the same spot the following year if they are fired at."

In all, I remained in the midst of the colony twenty-seven hours, covering the periods from 10:20 A. M. to 5 P. M. of July 3d, and from 3:30 P. M. July 6th to 11 A. M. July 7th. This gave me a little over a solar day of gull life, and, while very interesting, it lacked much of the exhaustiveness required to elucidate some of the conundrums presented. For one whose business would permit, it would be worth while to keep such a colony under fairly close observation from the time that it formed in the spring until it disbanded in the fall.

Gravel Island lies east of the peninsula, about a half mile off shore and about three miles south of its northern end. It forms the western border of the ship canal leading to the passage through Death's Door. The foundation of the island is a limestone reef that here comes to the surface and has received a considerable quantity of gravel and sand, raising the island in its highest parts about three or four feet above the water. In form it is somewhat boot-shaped, its longer diameter approximately north and south. It is about a hundred yards long by thirty to forty yards wide.

On the sandy portions grow a few clumps of sedges, while this year, near the center and surrounded by coarse gravel, was growing about a square yard of turf. In 1905 there were a few drift logs, which were largely increased in number this season, indicating that the waves of the winter storms probably run clear over the island.

In 1905 the nests, eggs and young birds were in quantity, and although there were great numbers of gulls, the terns were considerably more numerous.

The gulls' nests were mostly shallow saucer-shaped affairs of loosely matted sedges, cat tails, small sticks, bits of bark, blocks of wood, bedraggled cast feathers and other beach litter. The nests measured were fourteen inches or more in outside diameter and about seven and a half inches inside. Considerable difference was noticeable in their construction. Some were two or three inches thick, composed mostly of sedges well matted together, making a nest that could readily be picked up and carried in the hands. Others contained much less material, were of a less homogenous nature and so loosely thrown together as to be removable only with great care. See Figs. 3 and 4, Plate 1.

The eggs were two or three, with apparently about as many sets of one number as of the other. This was not because of incomplete laying, as in most instances incubation was well advanced, or one or more of the young were out of the shell. There was much variation in the size and color of the eggs. Three eggs selected from an unselected dozen appear to represent the amount of variation usually seen, though probably not the extremes. They measure in millimeters as follows: 66½x48½, 69x51 and 78x48½. Another egg taken July 1-3, 1905, unmarked, from its coloration I believe to be that of a gull (though its size agrees well with those of the Caspian Tern). It probably represents nearly or quite the minimum in size, measuring 62x41½ mm. The variation in color of eggs is from Ridgeway's Isabella color to a greenish gray most nearly corresponding to his pea green. Eggs of both colors were taken from the same nest. Some are very evenly spotted, with nearly circular marks of bistre. In others the markings are irregular blotches, sometimes with a decided tendency to form vermiculate lines. The spots may be strongly massed about the larger end, or this portion may be less marked than other parts. The colors are placed both on and beneath the surface of the shell. In the latter placement they appear not only much dulled but of a different shade. That they are of the same pigment may readily be demonstrated by scraping away the shell over these dull spots, when they will be exposed as bright and of the same shade as the others. The outlines given in the figure represent the exact sizes and shapes of two eggs from the above mentioned dozen and show normal variation.

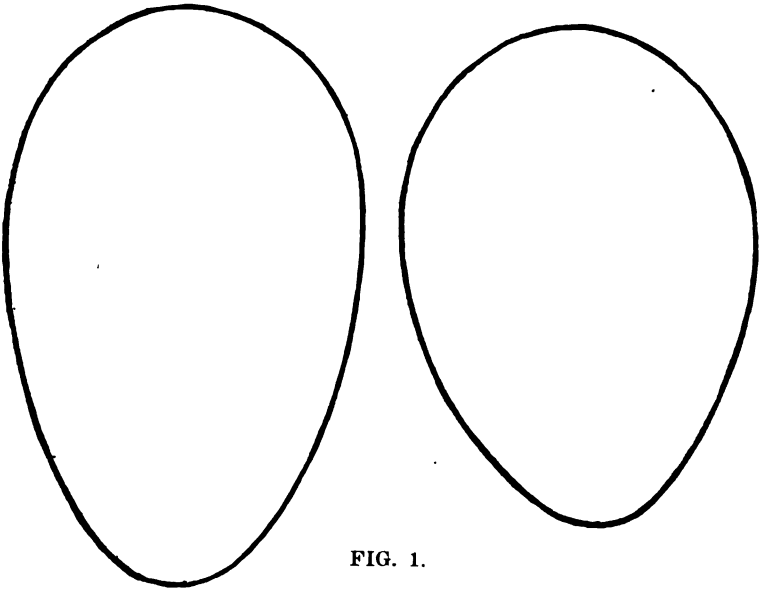

FIG. 1.

The Caspian Tern makes a slight hollow in fine gravel or sand, which, without any lining, serves for its nest. This varies from five to six and a half inches in diameter, by an inch and a quarter deep. A most remarkable feature of these nests, and one which I believe was present in all, was that each was surrounded by a clearly defined belt of small gravel and shells. *Goniobasis livescens* Menke. was the prevailing species, interspersed with a few *Lymnæa catascopium* Say. Fig. 1 of Plate 1 shows a poorly focused Kodak picture of one of these nests. It has suffered a further loss of clearness in reproduction.

The external diameters of nests measured gave from twelve to fourteen inches across these belts. In collecting for the purpose of making a group to represent the colony, in a few minutes' time we scooped up with our hands from about the nests several quarts of these shells, whereas a fish barrel filled with sand and gravel taken with a shovel from the general surface of the island yielded none at all when examined at the museum. It would therefore appear that these were brought from a distance by the terns and not collected from the surface of the island. Although to our eyes these rings possessed a decorative value, we hardly believe that they were placed there by the terns for that purpose. It is also difficult to believe that they were deposited by fecal ejecta, for there were no indications that these birds soil their own nests, as would be necessarily the case were this the source of the shells. If these were ejected from the mouth as are indigestible portions of the food of some birds, we would not expect them to so evenly encircle the nests, as most birds appear to have fixed habits of orientation when incubating or brooding.

The gulls seemed to be rather unsettled in their nidification, tending to the construction of more flimsy nests; but the materials that were used in these were essentially the same as employed in their more massive ones. If the terns have degenerated in nest building we would hardly expect that a remnant of this instinct would be exercised on such unnatural material as these small conical gastropods. Probably close observation of the nidification and incubation of this tern will yield a simple explanation of this phenomenon.

The eroded character of the shells and the broken walls of one or two whirls of most of them seem much like the ordinary beach worn examples of these species as found upon the lake shore at Milwaukee; but it is possible that a short time in the digestive tract of a bird might produce similar erosions. In this connection the following remarks of Sharpe would indicate that the placement of shells about the nests has been noted in England, though the habit could hardly have been noticed in as well marked examples without eliciting more detailed mention: "The latter (its nest) is only a depression in the sand with a few shells or bents of grass for lining."

Ridgeway says of its nesting: "Unlike most other terns, and conspicuously unlike the almost equally large Royal Tern (*S. maxima*), the Caspian Tern appears to breed in isolated pairs instead of large colonies, its nest being usually far removed from that of any other bird, and consisting merely of a shallow depression scooped in the sand, with little if any lining, though a few grass, or sedge, blades or other vegetable substances are sometimes added."

Both these authors mention the addition of grass, of which we saw none; and Ridgeway has found it a solitary breeder, while we found it in a colony of probably fifteen hundred birds, and its nests frequently less than a yard from its nearest neighbors.

Baird, Brewer and Ridgeway say: "The nests consisted of slight hollows in the sand, with a few sticks gathered round." The sticks could hardly be useful, and seem to indicate a remnant of a nest building instinct; or they might even be considered decorative. The subject should be investigated farther.

Variation is less marked in the tern eggs than in those of the gulls. Three specimens selected from a small number measure, in millimeters, 59x46, 60½x41½ and 64x42½. The ground color varies from cream to chalky white. The markings from fine dots, through spotted to blotched. One specimen noted is materially different in markings on one side than upon the other.

The laying of the Herring Gull at Gravel Island appears to be later than in many parts of North America, and its average number of eggs appears to be less. Hornaday writes of a pair nesting in the New York Zoölogical Park: "During the whole nesting period, lasting from April 1 to May 15, he either bluffed or fought to a standstill everything that came within ten feet of that nest." Several authors, without specifying locality, mention May as the laying month, while Audubon, writing of these gulls at the Bay of Funday, says: "Some individuals begin to lay about the 19th of May or a few days earlier, while others have not finished the process until the middle of June."

There is an unanimity among authors in assigning three as the proper number of eggs, yet in 1905 I noted that about half the nests had but two, and this year, out of five sets taken, four of them with large embryos, but a single set was of this larger number. Coues, writing of the gulls in Labrador, says: "The eggs, in all instances that came under my observation, were three in number; in other respects they showed the great variation customary in this family * * * * * *. Early in July eggs were found in every stage of development, though in most instances the embryos were advanced. At the same time many newly hatched birds were caught skulking beneath stones or scrambling over the luxuriant moss."

It would thus seem that our Gravel Island colony is considerably later than those of the Bay of Funday, which is about the same latitude, and corresponds very closely in date of hatching of the young with those observed by Coues on the Labrador coast much farther north. This correspondence would, I fancy, extend fairly well to the temperature of the waters of the respective regions at the time of laying.

Several young of both gulls and terns were seen in the nests freeing themselves from the egg shells, and others came from eggs after we had removed them from the island. On emerging they are wet, weak and keep their eyes closed. After a short exposure to the air their down dries, and though the young yet lie prone, their eyes open and they look much smarter. Fig. 4 of Plate I shows a young gull probably about an hour after leaving the egg. The skin of the belly is greatly distended, enclosing a large yolk quite outside of the body lines, and which seems to be used as a sort of cushion on which the young lies. The absorption of this store of food probably requires some days, during which time it is very unlikely that other food is taken. Unfortunately we could make no observations covering either of these points, both from lack of facilities and the pressure of other work.

After the young were large enough to run about, we had no evidence regarding younger stages, they were fed herrings; frequently so large that an inch or more of their tails projected from the mouths of the birds while the heads were being digested.

On Gravel Island and on Strawberry Islands, when we picked up the rather drowsy looking young gulls, they would at the time or a few moments afterwards make a few violent contractions of their abdominal muscles and throw up a fish, after which they would be more lively and frequently fight viciously to recover their freedom.

In December, 1886, on the Triangles, off the Yucatan Coast, I found the Gannets nesting, and whe I approached they would deposit a fish at my feet, a peace offering, I thought, to secure immunity from molestation, a tribute that they pay to the man-o'-war bird. These gulls were not, I take it, actuated by the same motive, but merely wished to rid themselves of ballast so as to get into fighting trim.

When this gull colony was visited this year most of the young were well advanced, nearly able to fly. (See Fig. 2, Plate 1.) They mostly kept together in a large flock, which I estimated to contain three or four hundred birds. It was too compact and kept too far away from my observation tent to allow of counting. Very likely it was larger, as it contained practically all the young of the colony. At one time I counted 360 adults upon the island, and estimated as many more in the air and upon the water. Seven hundred adults, if evenly divided as to sex, and all breeding, should have, barring accidents, about 875 young, and consequently my estimate of young was very likely too conservative. These young spent much of their time on the water, where, judging from the small number that sought to be fed by the adults, they probably obtained food for themselves.

The half dozen instances of adults feeding them that came under my observation were practically identical, varying only slightly in detail. The following is from my notes made on the spot while viewing the process: The young comes in front of an adult and with a bowing and courtesying movement puts up its bill to that of the old one, continuing the bowing for several minutes, resting between times. Sometimes it took hold of the adult's bill with its own, at other times merely touched bills. When the adult opened its mouth the young put its bill within. Failing to get indications of food, it went to another adult, and repeated the operation, passing in succession to several, until at length it seemed to get some favorable signs, for it remained by this one, alternately begging and resting. After some time it was apparent to me that the adult was striving to regurgitate. It would open its mouth, stretch its neck nearly horizontally, then bring its head down to the ground. After a moment it will close its bill, turn its head to one side and look at the ground over which it had been straining, as though expecting to find something there. Other gulls were from time to time attracted to the scene, but were promptly chased away by this bird, who ran rapidly at them with open beak and outspread wings. Perhaps half an hour after these efforts began I saw a portion of a fish appear in its mouth, and a moment later it was deposited on the ground, where the young promptly seized it. The fish appeared to be a herring about 7 or 8 inches long and so mascerated that it readily fell apart. The adult assisted in breaking it up, and I saw it pick out the vertebral column, which it dropped with the other pieces.

The young fed mostly from the ground, but occasionally snatched a piece from the bill of the adult. One of my photographs shows a young bird taking food in this manner, see Fig. 1, Plate 2. After some minutes I noticed that regurgitation was apparently to be repeated, and in about a quarter of an hour the remains of another fish were deposited on the ground and disposed of in like manner.

My notes at 7:30 P. M. read: "The young on my part of the island are bobbing up and down before adults begging their suppers. I can not see that there is any family relationship kept up. Most of the young are herded together; the others seem to beg food indiscriminately. The bobbing of the young seems to induce a similar motion in the adult, and if its craw is full a fish must come—at last I have several times seen them disgorge fish when "challenging" and when there were no young near, and then reswallow it."

"4:20 A. M. A perfect mob of young about one adult appearing to be on the point of regurgitating."

From all appearances the identities of the young were so completely lost that no adult knew its own offspring, and it was quite apparent that the young begged food from any adult. It also seemed to me that the adults were rather loath to render tribute in this manner, that it was a case of compulsion by a kind of hypnotism. The bobbing or pumping motion induced a similar motion in the adults. If a fish was in the upper part of the digestive tract the contortions probably gave it an upward motion, and they and the retchings continued until it was expelled. If the fish was farther along in its journey it probably was not interfered with by the contortions, which then soon ceased.

In Fig. 3 of Plate 2 we have an attempt at regurgitation by one adult which had induced larcenous desires on the part of another which drove back the waiting young and stood ready to snatch the fish should it appear.

The adults seemed to mildly object to feeding the young by trying to turn away and avoid the hynotic (?) influence, and I imagine that there was a certain degree of relief expressed in their actions when the inducement of regurgitation failed. It is hard to conceive that there should be anything pleasurable or voluntary in retching, gagging and vomiting for the benefit of an unknown young. It would be interesting to know whether this act is confined to one sex. The sexes were quite unrecognizable as they occurred on the island, but from the serial manner in which young went from one adult to another it is probable that no distinction in sex is made.

Both last year and this, when we visted the island, there were many dead half-grown young. Last year we were told that some summer visitors had gone to the island and wantonly killed birds; but some that were wounded and were put out of their misery by our party were injured about their heads in an inexplicable manner that caused me to doubt that they had been victims of tourists.

This season I had opportunity to see the manner of death of these birds, but could deduct no satisfactory explanation of the exciting cause. When first visiting the island, and still some hundreds of yards away from it, the young began to take to the water and swim away, so that when we stepped ashore nearly all had left. After the tent was set up and my companions rowed away, the return began, and in a few minutes the flock was swimming about close to the shore of the island. Several adults approached its flank and one began to deliver savage blows with its beak on the head of a young one, then seized it by the occiput and held its head under water, after which it pulled the half insensible victim about by its bill and legs. The young one ultimately reached the beach in a half insensible state and was lost to sight among the others. Several times I saw adults attack young in the water, but in all other instances the young escaped with little punishment. One that was hard pressed managed to reach a partially submerged rock, from which vantage point it put up such a savage fight as to quite disconcert and put to flight its persecutor. Again I saw young driven in shore onto the beach, and every adult near which it came would rush savagely at it.

driving it again into the water, until at length it reached temporary safety in the flock of young.

Those few stragglers near the center of the island that I saw attacked fared worse than those upon the water. The following account is from notes written in my observation tent while the action was taking place: "Time about 3:30 P. M., just after a rain squall. When this came up two of the smaller sized young huddled together beside a log. One showed by the livid color of its head that it had been maltreated. Soon an adult came up, grasped it by its upper mandible and dragged it out into the open, where it grasped it about the sides of the head and tugged it about. Then it let go and struck it several sharp blows on the head with the point of its bill, again grasped it about the head and pulled it about. When another adult came near, this one promptly let go its victim, sounded its challenge and again returned to its brutal task. After a time the young was exhausted and fell on its back, where it lay, occasionally kicking spasmodically with its legs. The adult plucked at its breast, tearing out beakfuls of feathers, pecked sharply at its wings, and also dragged it about by its wing feathers. Ultimately it left the young one lying motionless upon its back and apparently dead. However, after a few moments it began to move its members, struggled to its feet and attempted to make off. Several old ones intercepted it and one of them gave it another and similar beating, after which still another took a turn at the victim, whose head now looked much like that of a turkey buzzard. Finally it reached a log on which were two gulls that for some reason did not attack it, and here it stayed for some time, ultimately wandering to the beach, where it crouched miserably. Later on it again wandered inland and was set upon by an adult and so severely mauled that it was left apparently dead, though a half hour later it revived enough to crawl to the shelter of a log. This young is shown crouching beside the log in Fig. 1 of Plate 2.

While this last drubbing was being inflicted an adult bird flew to where the chastisement was being inflicted as though to interfere. It was immediately set upon by several onlookers and driven back eight or ten yards. Here it stood for some moments, facing those that had driven it, when it again attempted a sortie, but was restrained by the menaces of the others. Several of these then picked up small pieces of wood in their beaks, put them down and again picked them up. Another sortie was again blocked, followed by more picking up and putting down of beach debris. Herrick mentions that often the gulls' sparring bouts come to naught "when one or both birds seem suddenly to lose all interest in the quarrel, and begin to pick up chips, pull grass, or stab a rotten log with their strong, chisel-pointed bills." In this case these actions were performed in an apparently ostentatious manner, and I could not help thinking that by them it was intended to convey some information to the restrained bird.

I was quite unable to determine why the young were attacked. In the last described occurrence the young was wounded, the victim of a previous attack, but in various other instances there was nothing in the appearance or actions of the young to distinguish it to my eyes from any of the others. The habit of killing the young appears to be fairly common. I saw several instances in my short stay, and the dead bodies of young with the skin and flesh cut away from their occiputs were mute evidences of the prevalence of the revolting habit. One of the wounded young I removed from the island to the house where I boarded to see if it would recover. It would not voluntarily eat either raw or cooked fish or other food, so we were in the habit of opening its bill and pushing food down its throat. From the first it was evidently a doomed bird, sitting all the time huddled up, with scarcely life enough to offer any resistance when handled. After a couple of days it was evident that it was becoming thinner and weaker, and so it was killed. I found that below the occipital wound the neck was badly infested with maggots. This is probably the cause of death of any that may escape actual killing by their persecutors. There was much evidence that they not infrequently are directly killed by the adults, though I did not happen to observe any completely despatched.

I was quite unable to see that the victims of these attacks were in any way abnormal, or that they had given any offense. Some times the victim of an attack had for some hours been unmolested in the midst of the adults, when, as in the instance described, it was set upon while in the most passive state. Rapid movement seemed always to excite the adults and a running young one was sure to be attacked by every adult near which it passed, but these attacks that came under my observation consisted only of a few jabs of the beak on any part of the body, and none ended seriously.

In a recent article in a popular magazine descriptive of a gull colony at Lower Klamath Lake, Oregon, Finley writes: "By watching the actions of the parents, I soon discovered that their greatest anxiety seemed to be to keep their children crouching low in the nest, so that they would not run away and get lost in the crowd. I saw one young gull start to run off through the reeds, but he hadn't gone a yard before the mother dived at him with a blow that sent him rolling. He got up dazed and started off in a new direction, but she rapped him again on the head till he was glad to crouch down in the dry reeds.

"The parents seemed to recognize their own chicks largely by location. Several times I saw old birds pounce upon youngsters that were running about and beat them unmercifully. It seemed to be as much the duty of a gull mother to beat her neighbor's children, if they didn't stay home, as to whip her own if they moved out of the nest, but often this would lead to a rough-and-tumble fight among the old birds.

"Some times a young gull would start to swim off in the water, but it never went far before it was pounced upon and driven back shoreward."

Writing of the disagreeable conditions accompanying his observations he says: "We had to breathe the foulest kind of air on account of the dead birds and decaying fish scattered about * * * *."

Although the conditions at Finley's colony were somewhat different from those at Gravel Island, I am inclined to believe that the attacks on the young that he mentions, particularly when we consider the number of dead that polluted the air, were not greatly dissimilar to what I have described. The cause that he assigns for these beatings would not, however, be at all applicable to the Gravel Island occurrences.

In a description of the Laysan Albatross, Fisher, following an account of the regurgitation of food for the young, writes: "The young bird is not at all modest in its demands, but keeps asking for more. The old bird now pecks back in an annoyed manner, and if the other still urges, she arises and walks off, usually to some neighboring young one, which she viciously mauls about the neck. This exhibition usually takes place just before she feeds her young and likewise between courses, as it were. Why she does this I am at a loss to suggest, unless it be mere ill-will. The old bird does not always confine this ill treatment to one strange young bird, but takes in a circle of those whose parents are absent. The young thus rudely treated sometimes bite back, but usually do not offer resistance, uttering instead a plaintive little squeak. A small mortality is the result of this practice."

Here again we seem to have a similar habit in a different group of birds, and perhaps Fisher's suggestion that it is the result of "mere ill-will" is as good as we can offer. At the time of observation I suggested in my notes that perhaps the cause was impatience at having the young to care for. I have recently asked in "Science" for the observations or explanations of others. It would be interesting to determine whether both sexes took part in this slaughter.

Several writers speak of the sexes of these gulls as if they were readily distinguishable. There is, I believe, no distinction at all in plumage, and the smaller size of the female, if it exists at all, is so slight that neither Mr. Shrosbree, a taxidermist of many years' experience, nor myself were able to predicate the sexes of any of the twenty or more adults that we skinned until we made the necessary dissection. Only in cases were I saw the act of copulation could I be certain of the sex of one of the live birds.

When this year I first set up my tent among the gulls there were three people in the boat that went to the island. A position near the center of the colony was selected, the tent quickly erected and my camera and other paraphernalia placed within. While my companions were close by I stepped inside and closed the flap; then they went to the beach, pushed off the boat and rowed away. Within ten minutes swarms of gulls were hovering low over the island and tent and screaming loudly. Within five or ten minutes gulls had gathered on the ground within one or two yards of the tent. In one hour and ten minutes after the boat left a gull alit upon the tent and spent some minutes there screaming, and from then until I left the island there was an almost constant succession of gulls upon the roof of the tent, and sometimes two at once. The next time that I visited the colony, three days later, I was alone. I beached my boat, set up my tent and entered. Six minutes later the first of the young reached the island, followed two minutes later by the settling of the first adults, some on the island at its most distant point, but most in the water. It was an hour and thirty-five minutes before any came close to the tent, and not until half past four the next morning, or thirteen hours after setting up my tent, did the first one alight on it. The gulls on this occasion were quite uneasy and were frequently thrown into a panic by their own actions. The sudden alighting of a bird, or a fight between two, would frighten one, who, not waiting to see what was the trouble, would take wing, followed by one after another as the panic-formed wave swept over the island, leaving it almost bare of gulls. Fortunately they quickly recovered and returned, but their alertness and the frequent "*wak-wak, wak-wak*" of their note of suspicion showed that something bothered them. Apparently the departure of two people and the boat the first visit had deceived them into thinking that all had left the island, while on the second trip, although I had disappeared, yet no one had left the island, and for thirteen hours they remembered this and were suspicious. After the first gull alit on the tent they abandoned their suspicions and were as familiar with it as on the previous day.

Regarding the general intelligence of this bird the following from Audubon is pertinent: "They also take up shells in the air, and drop them on the rocks to break them. We saw one that had met with a very hard mussel, take it up and drop it three times in succession, before it succeeded in breaking it, and I was much pleased to see the bird let it fall each succeeding time from a greater height than before." Mackay states: "I have seen them carry up the same clam four times when it failed to break on account of insufficient height; but they will carry them up higher after several ineffectual attempts and thus obtain the desired result; they also carry up scallops (*Pecten concentricus*) and mussels (*Modiola modiolus*)."

When I first established myself in the colony I fancied that I must keep very quiet in order not to acquaint the gulls with my presence, and consequently took much pains not to rattle the stones under foot as I moved about within the tent.

The great feet of the gulls silhouetted on the roof of my tent as they stood upon it led me to experiment, and I was surprised to find that I could tickle them with the point of a lead pencil or even push it hard against them without apparently attracting the attention of the gull. Then I found that even when one was perched upon the pole I could strike sharp blows with a stone upon it without causing alarm. Not only must the jar from these blows have been violent, but it was also accompanied by a sharp noise. Carrying my experiments farther, I found that I could tramp about heavily on the loose gravel, could cough, whistle or sing without apparently causing the slightest uneasiness to gulls on top of the tent or upon the ground within a yard or two of its wall. I also found that I could smoke and that when a cloud of smoke issued from one of my loop holes and drifted full in the face of a gull a few feet away it appeared to produce no effect. A quick movement of the face or of a hand at one of these openings was sufficient to cause a stampede, which, however, seemed to be forgotten almost immediately. The black front of my reflecting camera with its sunken lense did not seem to disturb them and the considerable noise of its swinging mirror accompanied by the the swish of the shutter when an exposure was made produced no panic, although it sometimes attracted attention. It therefore seemed as if sight, and particularly that of a rapid motion, was about all that disturbed the gulls, and that they were remarkably obtuse to evidences of my presence that would have required little intelligence to appreciate.

The noises of the colony were continuous and varied. I fancy that I am safe in saying that there was not one second of the twenty-seven hours' observation but that one or more gulls was calling, and frequently there were several hundred screaming at once. Some times one hears sounds like the lowing of cattle, except that the pitch is higher, like the bleating of sheep, the mewing or snarling of cats, the clucking of hens, the crowing of cocks, hoarse human chuckles, and sounds for which I could find no comparisons. The first day that I was in the tent, at 3 P. M. a rain squall came up. Dark clouds obscured the sun, occasional flashings of lightning were seen and peals of thunder sounded from time to time. The wind came in cold sharp gusts. The shrill cries of the gulls were quickly subdued and a plaintive mewing was the all-prevailing sound. English writers not infrequently mention the mewing of the gulls, but I had never before heard any number of gulls whose prevailing sound was so well described by that term.

Frequently the general clamor would be dominated by a peculiar cry which I put into words as *"yeh, yeh, yeh,"* rapidly repeated and increasing in vehemence to the utmost capabilities of the gull, when it quickly ceased. Usually a few seconds after one began another joined, until often there were a half dozen birds screeching at once, and occasionally this number would be increased to a score or more. This is a definite vocal effort, always produced in its peculiar attitude. Probably a dozen or fifteen of my photographs show one or more birds executing it, and some show six or eight engaged. Fig. 4 of Plate 2 shows a close front view of a couple of "challenging" gulls. Any thing that startles the gull without producing a panic, or the proximity of fighting birds, or even at times the approach of others seems to be sufficient cause for its production. The bird stretches its neck downward, opens its bill widely and begins the call, then with a jerky sort of start it stiffly raises its outstretched neck, usually to an angle of about forty-five degrees. Generally, almost invariably, the head, neck, body and tail are all held in practically the same line and in a remarkably stiff manner. The whole operation is so machine like in its rigidity and precision of motion that the gulls appear like a lot of automatons. If the challenge, or "scream of defiance" as Herrick terms it, is not answered it may cease in perhaps a quarter of a minute, but if answered it is continued to about double that time.

Another peculiar and definite combination of attitude and voice at once reminded me so of descriptions of the "dance" of the Albatross at Laysan that I at once entered it in my notes as a dance. It lacks much of the complexity of the Albatross dance, in fact, as I saw it many times repeated, it is but a single stage in that remarkable performance. A comparison of the birds in the foreground of Fig. 2, Plate 2, with Fisher's "First steps in favorite dance," Fig. 25, Plate 6, will show the similarity. Two adults may be standing near together when one will stoop, hold its neck nearly horizontal, its bill pointed down, move its head in and out from its body, and slightly up and down, in a rapid jerky way, reminding one somewhat of the motions of a duck feeding in shallow water, at the same time emitting a peculiar chicken-like chatter. The other one immediatly joins in, apparently directing its attention to the same place on the ground, and the performance is kept up for a minute or two, when the birds straighten up; perhaps to repeat the operation two or three times with short intermissions. There was no assignable cause for the performance and no observable result. Without any satisfactory clew, it was suggestive of having some relation to the selection of a site or the building of a nest. Two birds usually took part, one of my photographs apparently shows three, but whether or not these were pairs I could not tell. There was a lack of point to the affair that leads me to suspect that it may be a remnant of a more elaborate ceremony indulged in earlier in the season.

Incipient nest building was going on continuously. There were, perhaps, half a dozen nests with fresh eggs, but most that I collected contained large embryos. I saw no new nest making that seemed likely to be carried to completion, but observed a score or more of gulls picking up sedges and other materials, carrying them to some spot, frequently beside a log, and depositing them. Not infrequently one billful would be all that would be brought to that spot, and no farther attention would be paid to it after it was laid down; but some gulls had a stronger trace of unsatisfied nesting instinct (as Herrick had called it) and brought several loads to the same place and went through the motions of moulding the nest. This was accomplished by dropping the breast onto the gathered material and with the posterior part of the body tilted upwards and the feet straining, pushing it into shape with the breast. There seemed to be no attempt to arrange the material with the bill. Late in the evening one bird near my tent who had gathered three or four handfuls of rubbish spent some time moulding it, and then complacently sat upon the shapeless mass for several hours.

Copulation occasionally, though rarely, took place on the island during my stay. I observed it three or four times. The preliminaries were short and were quickly followed by the female squatting slightly. The male then jumped upon her back, trod for some moments, then turned his tail sharply down and swung it back and forth like a pendulum, brushing against the female's tail. She invariably raised hers to the left and he brought his down to the right. When coition was complete the female raised her neck and head straight upwards and the male caressingly rubbed his bill against hers and then jumped to the ground.

A few gulls were still incubating. The weather was pleasantly warm, though not hot, yet the sitting gulls, near enough for careful observation, kept their bills open most of the time, as does a bird suffering from the heat. Gulls standing about were not doing this. In these sitting birds the end of the tongue was curved upward, so that about an inch of it appeared rising from near the end of the lower mandible. In no other instances, whether screaming or doing anything else that required the mouth to be open, could the tongue be seen from a side view; apparently lying passively between the lower mandibles.

The gulls, adult and young, usually stood squarely upon both feet. It was very rarely that one was seen standing on one foot.

Sleep seemed to occur perhaps a little more frequently during the warmer hours of the afternoon than at other times, though pretty evenly distributed through the twenty-four hours. The birds sometimes stood, but more frequently squatted on the ground and turned their heads over their backs and tucked them under their wing feathers. Sleep was of very short duration, as fights, panics and alarms of various sorts followed one another too closely to allow of unbroken repose for more than a few minutes at a time. The night that I spent among them there was less sleep than during the day. The sun set about half past seven; but at eight o'clock the colony was as busy as ever fighting, making abortive nests and screaming. At ten minutes past eight the moon arose, and ten minutes later nearly all the gulls suddenly took wing in what I conceived to be a panic, until shortly afterwards I spied a large flock of them on the water in the direction of the moon. Later they worked around the island, so that I was between them and the moon, and I could then see that they were busily fishing. My notes continue up to a quarter of three, when I fell asleep with the gulls still on the water and noisy. When I awoke at twenty minutes after four the sun was up, most of the gulls were on the island and many young were teasing a few adults for breakfast.

At this season of the year there was no rivalry for mates and the fights that were frequently occurring were from petty causes only. None were severe or long continued and consisted mostly in one taking another unaware and pulling its tail or wing feathers. Occasionally a face to face encounter occurred, and in these the attempt seemed to be to grasp the opponent by one of the mandibles and drag him about. In these clinches one bird had the other by its upper mandible and was itself seized by the lower one. Which hold was considered the preferable I could not determine. The larger young were frequently fighting among themselves and were addicted rather to quick thrusts with their beaks than to pulling. Several times I saw clashes between fully grown and half grown birds, in which the latter were victorious. I imagined that a sort of chivalry kept the adults from fighting as hard as they might have done were their opponents larger, but the young were noticeably quicker and more savage in their thrusts.

It was with much regret at the fragmentary nature of my work and at the many unsolved problems of larine sociology which I must abandon, perhaps forever, that I discarded my mantle of invisibility by stepping out of the tent, and amid the frantic shrieks of nearly a thousand panic stricken gulls took my departure.

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EXPLANATION OF PLATES.

Plate 1.

Fig. 1. Nest of Caspian Tern containing three eggs. Taken with a kodak July 1, 1905. Out of focus and further obscured by reproduction.

Fig. 2. Young Herring Gulls standing near my tent.

Fig. 3. Nest of Herring Gull with three eggs taken July 6, 1906.

Fig. 4. Another gull nest with recently born young, taken on same day.

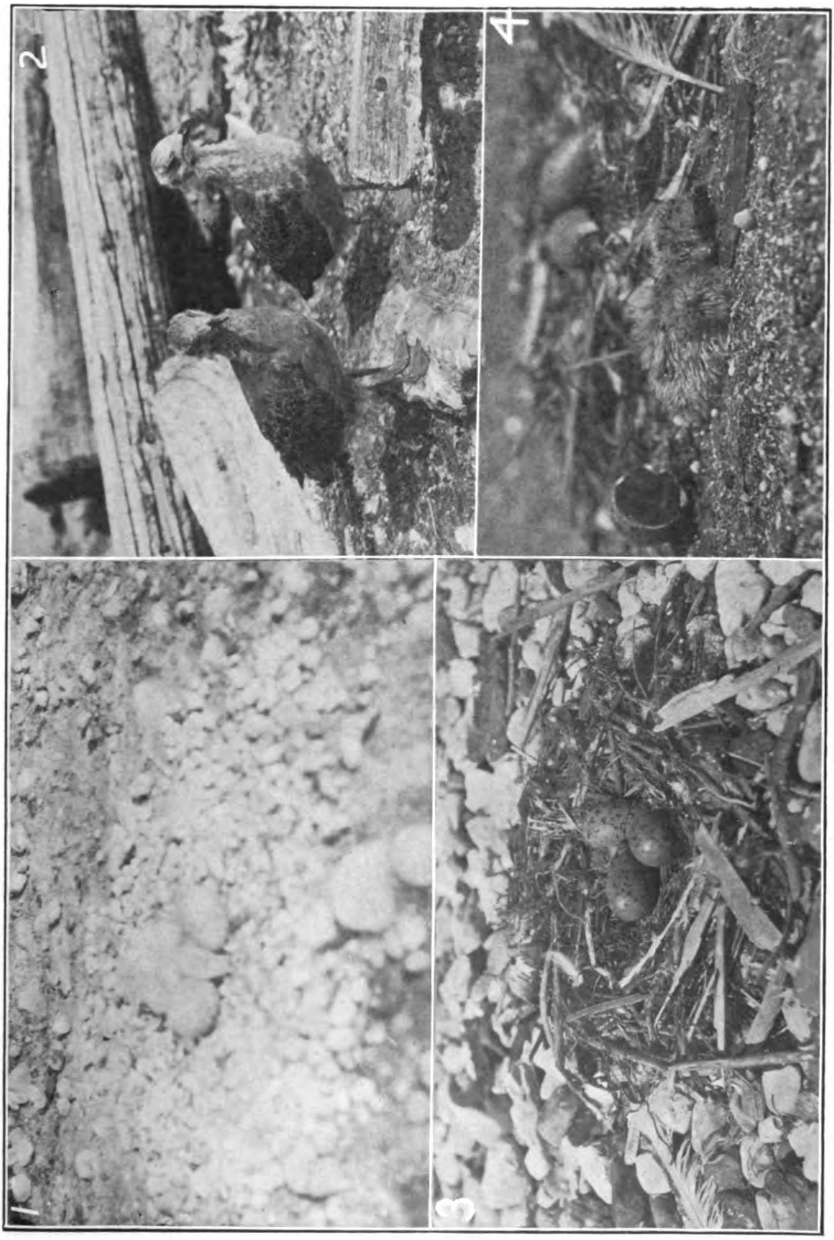
Plate 2.

Fig. 1. Young Herring Gull taking food from bill of adult; severely wounded young crouching by log.

Fig. 2. Two gulls performing "dance."

Fig. 3. Adult attempting to regurgitate a fish for young. Another adult has come near while this one was unable to resent its approach, has driven the young back and stands ready to seize the expected fish.

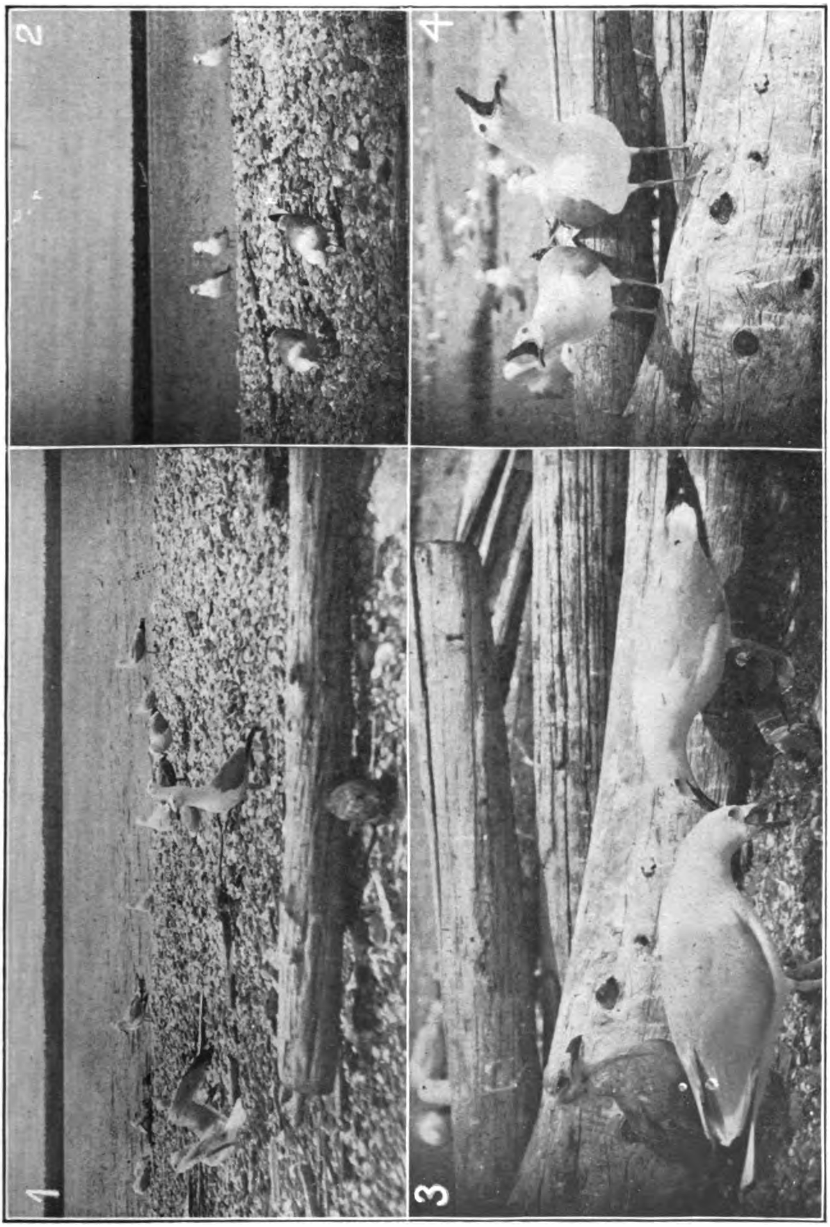
Fig. 4. Adult gulls "challenging."



THE HERRING GULL AND CASPIAN TERN.

FOR EXPLANATION OF PLATE SEE PAGE 134.

Bull. Wis. Nat. Hist. Soc., 1906.—Ward. Plate 2.



THE HERRING GULL AND CASPIAN TERN.

FOR EXPLANATION OF PLATE SEE PAGE 134.

A CONTRIBUTION TO OUR KNOWLEDGE OF THE VISUAL MEMORY OF BEES.

BY S. GRAENICHER.

Various writers have undertaken an explanation of the ease and certainty with which bees and wasps are able to find their nests, even when returning from a considerable distance. Within the last few years a rather spirited discussion of the questions involved has been brought about by A. Bethe, who has maintained that these insects are directed to their nests by an "unknown power," i. e., some mysterious power unknown to us. His views were derived mainly from studies of the honey-bee. On the other side, the observations of Lubbock, Friese, von Buttel, Forel, etc., on bees, and of Mr. and Mrs. G. W. Peckham, Bouvier, etc., on wasps, have established the fact that such an insect by making a careful inspection of the immediate and extended neighborhood of the nest in all its details, and storing up the manifold visual impressions thus gathered in its memory, is enabled to find its way back to the nest, as also to find its way from the nest to certain objects of interest, flowers and other sources of food-supply, for example. So far as bees are concerned, the highly specialized among them, viz., the social bees, have been studied in this connection, in the majority of the cases the honey-bee, but occasionally also the bumble-bees. I herewith offer the results of a few observations relating to this subject made on a solitary bee, *Alcidamea producta* Cr., and a parasitic bee, *Argyroselenis* (*Triepeolus*) *minima* Rob.

A. **Alcidamea producta** Cr.

The nests of this species are situated in the dry stems of various plants, rather frequently in those of the blackberry, and the bee has to excavate the pith to a depth ranging from about 7 to 15 cm. or even more. This work of excavation requires a day or two, and while thus engaged the bee often interrupts its work, and flies around in the neighborhood, sometimes in search of food, but usually on a tour of inspection. On several occasions I have witnessed the actions of such a nest-building bee from the beginning on. After digging away for several minutes the bee leaves the nest, and flies around the stem, and up and down along the latter, paying much attention to details such as thorns protruding from the stem, leaves, branches, etc. Thereupon the insect takes a look at some other stems or other objects in the vicinity, and returns to the nest for further work. After a while the bee reappears, goes over the field studied in the previous trip, extends its observations over a new stretch of territory, and reenters the nest. In this manner, dividing its time as it does between digging and inspecting, the bee gradually increases the depth of the gallery, and it also increases its knowledge of the topography of the surroundings. By the time the gallery has been completed and the bee is able to begin with the storing away of pollen and honey in the first cell it has become entirely familiar with the locality. When returning to the nest it passes objects of different size, shape and color, and its memory of these, as well as of the relative position of these objects to one another, makes it possible for the bee to find the nest with little difficulty. As the days pass by it gains through frequent practice, finally its actions become more or less automatic, and it flies swiftly and directly to the nest without seemingly taking any notice whatever of the objects en route.

A specimen of *Alcidamea producta* with its nest in a blackberry stem was observed at Cedar Lake, Washington Co., Wis., on July 20th, while at work carrying in the food-supply for a cell. The upper portion of the stem containing the nest was protruding slightly from a group of blackberry plants, and it was bending over so as to be nearly horizontal. The nest-opening was about 8 dm. above the ground. The bee was bringing in its load of pollen and honey about every 9 minutes on the average.

Two days later, on July 22nd in the forenoon, this same bee had provisioned all of its cells, and was engaged in closing the entrance to the nest with the customary plug, the so-called "outer defense," consisting of a paste of chewed pieces of leaves. On its way to the nest it came flying in along the group of blackberry plants following a direct course to the nest, and always appearing from the same direction for the simple reason that the strawberry plant, from the leaves of which it was obtaining its building material, was situated in that direction. This bee was certainly quite familiar with the locality, and I decided to change to some extent first the site, and then the appearance of the nest-entrance, for the purpose of noting the effect on the bee's behavior.

The bee was visiting and leaving the nest as follows:

entering at 10:48:13 A. M.
leaving at 10:48:50 A. M.
entering at 10:49:10 A. M.
leaving at 10:51:20 A. M.

Experiment 1.— As soon as the bee had departed the stem was pushed upward, and in this manner the nest-entrance was placed 3 inches above the former site and brought into somewhat different surroundings.

At 10:52:10 the bee returned along the usual course leading to the former site of the nest-entrance. Not finding the latter immediately it started to fly around, and soon discovered the opening, but it made a careful survey of the stems and grasses around it before entering at 10:52:52, 42 seconds after its return.

At 10:53:35 it left the nest, and returned again at 10:54:10 to the former site of the entrance. It did not go in until 10:54:20 (10 seconds later), after having examined the surroundings as before.

In its subsequent visits it

returned at 10:56:58, entered at 10:57: 5 (7 seconds);
returned at 10:57:58, entered at 10:58: 0 (2 seconds);
returned at 10:59:40, entered at 10:59:42 (2 seconds);

always flying in too low before finding the entrance.

At the next visit, at 11:00:45, it flew directly to the entrance without an error, and the same was the case with all of the following visits at

11:1:30,
11:2:20,
11:3:40,
11:5:18,
11:7: 5.

Experiment 2.— The bee had evidently become acquainted with the new order of things, and a blackberry leaf with a round hole in the middle was pushed over the end of the stem. The entrance to the nest was now situated in the middle of the vertical green leaf, and this arrangement had given to the immediate surroundings of the nest opening quite a different aspect.

At 11:8:50 the bee returned to the opening, but seemed greatly disturbed, and did not enter until 11:9:10 (20 seconds later), after a thorough examination of the leaf by flying around it and behind it a number of times. It left as usual.

At 11:11:28 it was back again, but entered only at 11:11:35, 7 seconds later, and in the meantime made an inspection of the leaf. This it also did at the next visit at 11:13:50, but it went into the nest 3 seconds later at 11:13:53. At 11:16:10 it entered directly, without any hesitation, and from this time on it did not seem to pay any attention to the leaf whatever.

These experiments show that the solitary bee under discussion is capable of adding new visual impressions to its memory within a short time. It learns easily, and soon becomes acquainted with changes in the surroundings of its nest. In the first experiment the insect was guided by the new impressions from the sixth visit on, although the previous impressions had been the dominating ones throughout a comparatively long period. It is also interesting to note how from visit to visit the time spent in studying the new surroundings became shorter. The insect had evidently less to learn on each subsequent visit until it had become entirely familiar with the situation. In the second experiment the insect had overcome the difficulty at the fourth visit, and the time spent in studying the altered conditions was much less than in the first experiment. It would therefore seem that by changing the site of the nest we confront the bee with a more difficult task than by changing the appearance of the nest-entrance.

The actions of this bee when dealing with changes in the topography of the surroundings of its nest are identical with those exhibited when it has undertaken the building of a new nest. In each instance it submits the region around the nest to a thorough and repeated inspection, and keeps the visual impressions resulting therefrom in its memory. This is quite in accordance with the facts obtained for social bees and wasps as referred to at the beginning of this paper.

B. **Argyroselenis minima** Bob., a parasitic bee:

While watching a nest of the leaf-cutter bee, *Megachile latimanus,* at Cedar Lake, Washington Co., Wis., on the afternoon of July 13, 1903, I noticed a parasitic bee, *Coelioxys rufitarsis,* making three visits to the nest within 27 minutes. This bee seemed to possess a certain knowledge of the locality, since it always found the entrance to the nest, hidden among the grass on a hillside, nearly as easily as the owner itself. At that time I was under the impression that it was always the same individual returning to the nest.

Last year at the end of September I dug a nest of the same species of leaf-cutter bee out of a clay-bank at Milwaukee, and after having replaced the earth, and in this way removed all traces of the nest, I was surprised to see a parasitic bee, also *Coelioxys rufitarsis,* appear near the former site of the nest, and hunt around as eagerly as if it was looking for a nest of its own. This observation strengthened me in the belief that parasitic bees, or some of them at least, after having come across a suitable nest of a host-bee, become acquainted with the locality, and return to the nest from time to time.

In order to settle this question it seemed to me essential to follow up the actions of a parasitic bee from the time that it made its first acquaintance with a nest of a host-bee. Such an opportunity presented itself in the summer of the present year, and I offer an account of the observations in detail, as contained in my notes.

August 12, 1906.

> A nest of *Colletes eulophi* Rob. is situated in a clay-bank in Lake Woods (between Milwaukee and Whitefish Bay), the opening to the nest being about 3 dm. below the top of the bank. A specimen of a parasitic bee, *Argyroselenis minima* Rob. comes flying leisurely along the bank, examining every hole or crevice on the look-out for a nest of its host-bee. It discovers the nest of *Colletes*, and shows much excitement, crawling over the ground with quivering wings, approaching the nest from different sides, and looking in, but not entering. It soon takes up a position on a small plant about 2 dm. above the nest, and waits patiently and motionless until the owner arrives with its load of pollen and honey, and disappears in the nest. Thereupon *Argyroselenis* becomes restless, undertakes a general preening of its body, the antennæ first and again becomes quiet. After the departure of the owner, the parasite first goes through the preening process

again, and enters the nest at 12:10:15 P. M., staying in until 12:11:20. It then spends nearly 6 minutes studying the territory around the nest, at first only the immediate vicinity, but gradually extending its excursions to a distance of 3 m. to the east and west, also above, flying over the top of the bank, and below. It frequently returns to take a look at the nest, and it rarely ever passes through the neighborhood of the latter without taking notice of it. At 12:17 it departs but is back again at 12:31, and this time, judging from its behavior, it is less excited than at first, it displays a certain familiarity with the surroundings, and leaves again after looking at the nest.

August 13.

I arrived at the nest at 11:14:30 A. M. The parasitic bee (probably the same specimen) was already there, sitting on a rootlet above the nest. At 11:15:10 the host-bee arrived, entered, and left again at 11:26:25. During these 11 minutes the parasite became impatient, and changed its position quite frequently, sometimes sitting to one side of the nest, sometimes to another on some small plant, but always facing the nest. It usually took a glance at the latter when flying from one plant to the other. It acted as if more at home and much more unconcerned than yesterday. It remained quiet for about 20 seconds after the departure of the owner, and then it visited the nest, remaining inside only about 15 seconds. After this several excursions along the bank on both sides of the nest were made, the parasite always turning its head towards the nest when passing by. It then left. Its behavior on this day pointed to an intimate acquaintance with the locality. At 12:8 P. M. I went away, and up to this time the parasite had not returned.

August 14.

At 9:36:20 A. M. I visited the nest and found *Colletes* engaged in clearing out the nest. *Argyroselenis* was already there, flying around the nest, but before long it alighted on a leaf nearby. I felt certain that I had been dealing throughout these days with the same individual of *Argyroselenis minima*, but in order to leave no doubt about this I caught the specimen at 9:40, marked the back of the mesothorax distinctly with a bright red crayon and set it free. It flew away and had not returned again at noon, when I left.

August 15.

> At 9 A. M. the nest is still closed, although the weather is bright and warm. At 9:20 our old acquaintance *Argyroselenis*, easily recognized by the bright red mark, arrives, inspects the nest, and, as usual, takes up a position on a small plant. It waits until 10:18, but the nest has not yet been opened, and it flies away. Every once in a while it returns, examines the nest-entrance, and alights on a neighboring twig or leaf, remaining motionless for many minutes at a time.

August 16.

> An examination of the nest showed it to be completed and closed definitely. This had undoubtedly been the case the previous forenoon. Nothing more was seen of *Argyroslenis*, nor of *Colletes* the owner of the nest.

It is quite evident that after having discovered the nest this parasitic bee pursued a course similar to that of a host-bee when constructing a nest. It started out to make a careful and repeated inspection of the environment of the nest, gradually covering more territory in different directions, but often returning to the nest as the main object of its attention. Being possessed of a good memory for visual impressions it became acquainted with the locality within 6 minutes, and experienced no difficulty in refinding the nest at its next visit after an absence of 14 minutes. It gradually acquired a thorough familiarity with the topography of the region, and on its return to the nest it was seen to fly towards the opening as directly as the owner itself.

Such a parasitic bee when hunting for a nest of a host-bee is not always flying around in a haphazard way, trusting to its good luck in finding a nest here to-day, and one somewhere else to-morrow. When it has come across a suitable one it is very careful to keep this under observation, and in making its trips to and away from the nest it is directed by its visual memory in exactly the same manner as the host-bee itself. It would not be in the interest of such a bee to pursue a different course. The work of the host-bee in constructing a cell, and providing it with the food-supply must have progressed to a certain point before the parasitic bee may find it suitable for the reception of the latter's egg. For this reason such a bee usually has to make repeated visits to the nest, in order to be on hand when the right time comes. If it were in the habit of wandering around until it happened to come across a host-bee's cell in the proper stage of construction, then it might not get much chance to deposit an egg within its lifetime of a few weeks duration, especially in rainy seasons. It is even possible that a parasitic bee has more than one nest under observation during the same period.

Of course I do not wish to be understood as applying the statements set forth above to parasitic bees in general, but I have good reasons for believing that in this respect the behavior of the species of *Triepeolus, Coelioxys* and *Stelis* known to me agrees with that of *Argyroselenis minima.*

NOTES AND DESCRIPTIONS OF NORTH AMERICAN PARASITIC HYMENOPTERA. II.

By Charles T. Brues.

BETHYLIDÆ.

Pristocera hyalina sp. nov.

Male. Length 7.5 mm. Black, the wings hyaline, body less coarsely sculptured than in *P. armifera* Say. Head strongly punctured, the punctures distinctly separated toward the vertex and widely so on the cheeks. Mandibles and palpi entirely black; antennæ 13-jointed setaceous, first flagellar joint one-third longer than the second, others sub-equal and gradually lengthening to tip. Collar closely and evenly punctured, pleura of prothorax punctured above, smooth medially and obliquely striate below. Mesonotum with four furrows, shining, strongly and sparsely punctured, the scutellum smoother. Coxæ and pleuræ with well separated and only moderately strong punctures. Metathorax distinctly areolated basally, irregularly rugulose elsewhere. Abdomen oval, shining. Wings hyaline, stigmal and submarginal vein black, other veins brown. Marginal cell open, not narrowed. Discal nervures not indicated; sub-median cell indistinctly longer than the median. Legs black, the tarsi piceous. Body everywhere sparsely clothed with grayish white pile.

Described from a male specimen from Austin, Texas; collected by the writer.

This species comes near to the common *P. armifera* Say, but differs by its hyaline wings and less strongly punctured body. The difference in punctation is most marked on the cheeks, pleuræ and coxæ.

Epyris secundus n. nov.

Epyris analis Kieffer, Ann. Soc. Sci. Bruxelles, Vol. 29, pt. 2, p. 17 (1905), (nec Cresson, Trans. Am. Ent. Soc. IV, p. 193 (1872).

Aphelopus varicornis sp. nov.

Female. Length 1.75 mm. Black, legs and first two antennal joints light yellow; face below the ocelli white. Head finely shagreened, shining black, the face white below the frontal ocellus. Clypeus truncate, mandibles white with three black teeth; palpi white. Antennæ 10-jointed, the scape and pedicel yellow, flagellum black; scape and pedicel about equal, stout; second and third flagellar joints the longest. about equal; first and fourth equal but shorter, fifth, sixth and seventh shorter, the apical one one-half longer than the penultimate. Mesonotum black, shagreened, with distinct furrows on the anterior two-thirds. Metathorax rounded behind, areolated and rugulose. Abdomen small, compressed, shining back. a little shorter than the thorax. Legs, including coxæ, pale yellow, the posterior femora and tibiæ infuscated. Wings hyaline; stigma rhomboidal, radial vein a little longer than the stigma, faintly curved at the tip.

Described from a female specimen collected at Woods Hole, Mass., July, 1903.

The present species resembles *A. melaleucus* Dalm., but differs in the color and configuration of the antennæ. It could hardly be the female of *A. americana* Ashm., of which only the male has been described, on account of the truncate clypeus.

CERAPHRONIDÆ.

Ceraphron Jurine.

Since the publications of Ashmead's Monograph of the North American Proctotrypidæ in 1893, four additional North American species have been described, and the two added here bring the total up to twenty-four species. As pointed out by Dalla Torre (Cat. Hym. V, p. 524) *basalis* Ashm. (nec Thomson) must be known as *tertius* D. T. I cannot adopt his change of *fusciceps* Ashm. to *secundus* D. T. as the name *fusciceps* is not identical with Ratzeburg's *fuscipes*.

Our species, exclusive of West Indian forms, may be distinguished by the following table, which is based almost entirely on females:

NORTH AMERICAN SPECIES OF CERAPHRON.

1.	Winged	2
	Wingless, or with abbreviated wings	21
2.	Head, thorax, and abdomen black	3
	Body, or at least the abdomen in part pale or brownish	17

3. Antennæ unicolorous, entirely black or fuscous (at least in the female) 4
Antennæ bicolored, at least the scape pale or yellow.......... 9
4. Legs entirely black.......... 5
Legs in part yellow or pale.......... 6
5. First flagellar joint 2½ times as long as thick, penultimate 1½ times as long as thick (male).......... **glabricornis** Kieffer
First flagellar joint 4 times as long as thick, penultimate 2½ times as long as thick (female) .... **unicolor** Ashmead
6. Pedicel not longer than the first flagellar joint.......... 7
Pedicel as long as the first and second flagellar joints together **salicicola** Ashmead
7. Second abdominal segment a little longer than the rest united, second flagellar joint hfalf the length of the first. **melanocerus** Ashmead
Second abdominal segment twice as long as the rest united.... 8
8. Female. Second flagellar joint ⅔ the length of the first. **carinatus** Ashmead
Male. Flagellum longer than the body, scape brownish yellow. **carinatus** Ashmead
Male. Flagellum considerably shorter than the body, scape black .... **brevicornis** sp. nov.
9. Head and thorax closely, distinctly punctate.......... 10
Head and thorax smooth, or at least finely shagreened........ 11
10. Pluræ aciculated, flagellar joints 2-5 transverse. **punctatus** Ashmead
Pluræ smooth, flagellar joints 2-5 longer than thick. **quissetensis** sp. nov.
11. Legs uniformly yellow or pale brown.......... 12
Legs with the femora and tibiæ infuscated, wings subfuscous, first flagellar joint as long as the pedicel, flagellum subclavate. **amplus** Ashmead
12. Thorax black, collar sometimes pale.......... 13
Collar black, maculate with yellow on each side, post-scutellum not spined, first flagellar joint ⅔ as long as the pedicel **croceipes** Brues
13. Wings clear hyaline.......... 14
Wings subfuscous or tinged with yellowish.......... 16

14. Second flagellar joint quadrate.............................. 15
Second flagellar joint transverse...........**flaviscapus** Ashmead
15. First flagellar joint twice as long as thick....**nevadensis** Kieffer
First flagellar joint one and one-half times as long as thick... **mellipes** Ashmead
16. Tegulæ black ....**pedalis** Ashmead
Tegulæ pale ....**glaber** Ashmead
17. Thorax black or piceous........ 19
Thorax brownish-yellow... 18
18. Head black, abdomen brownish-yellow..**melanocephalus** Ashmead
Head brownish-yellow, abdomen black .... **californicus** Ashmead
19. Flagellum of antennæ brown (male)........ **longicornis** Ashmead
Flagellum in part black....................................... 20
20. Flagellum of antennæ entirely black, only the scape rufous, wings hyaline .... **pallidiventris** Ashmead
21. Four or five apical joints only, black; wings tinged with yellow- **tertius** Dalla Torre
Entirely black, with slight traces of wings, legs golden yellow **auripes** Ashmead
Not entirely black... 22
22. Entirely yellow or brownish-yellow........................ 23
Black, only the base of the abdomen yellowish, antennæ except scape black, wings entirely absent......... **minutus** Ashmead
23. Wings entirely absent, vertex of head fuscous **fusciceps** Ashmead
Wings present, but short and narrow, reaching only to the middle of the first abdominal segment, antennæ black except base of scape .... **crassicornis** Harrington

Ceraphron brevicornis sp. nov.

Male. Length 1.3 mm. Black, legs piceous, the tibiæ and tarsi honey-yellow. Head shining, smooth, shagreened below on the face; vertex impressed laterally behind the ocelli, and with a slight impressed groove extending back from the anterior ocellus and a similar one on the front below the ocellus. Antennæ entirely black; scape a little shorter than the head height, flagellum a little shorter than the body; pedicel small, moniliform ; first flagellar joint 2½ times as long as thick and fully three times as long as the pedicel; second flagellar ⅔ the length of the first, the two together about as long as the scape; following each as long as the second, the last ½ longer. Thorax smooth, shining, scarcely shagreened, the median line strongly impressed; axillæ meeting distinctly before the scutellum, the latter 1½ times as long as wide, with a marginal frenum. Pleuræ smooth, the metapleuræ above slightly striate or rugose; hind coxæ rugose. Postscutellum with a short pyramidal spine; lateral angles of metanotum acute, its surface rugose. Abdomen about as long as the head and thorax, the second segment about 1½ times as long as the remaining segments together, striate on the basal fourth. Legs brown, the femora strongly darkened medially, the coxæ black, rufous at their tips. Trochanters, tips of tibiæ and tarsi honey-yellow. Wings distinctly tinged with fuscous, more strongly so anteriorly. Stigmal vein long and curved, 2½ times as long as the stigma.

One female from Milwaukee, Wisconsin, June 1, 1906.

This species resembles *C. carinatus* Ashmead, but differs from the male of that species by its shorter flagellum and black scape.

Ceraphron quissetensis sp. nov.

Female. Length 1.4 mm. Black; the legs, including coxæ and base of antennal scape yellow. Head rather strongly punctate, about twice as wide as thick antero-posteriorly; vertex not or scarcely impressed behind the ocelli, the median impressed line evident from behind the ocellus to the edge of the facial basin which is deeply impressed. Antennæ 10-jointed, slender, not incrassate toward the tips. Pedicel scarcely longer than the first flagellar joint; second, third, and fourth flagellar joints equal, each two-thirds the length of the first, the second not quite twice as long as wide; fifth, sixth, and seventh growing longer, the last joint one-half longer and sharply pointed. Scape and flagellum black, the basal half of the scape yellow; the scape half the length of the flagellum. Mesonotum distinctly punctulate, the median line distinct; axillæ united in front of the scutellum, the latter about one-half longer than wide. Postscutellum spined; pleuræ smooth, except the upper part of the metapleuræ which is more or less irregularly roughened and not distinctly ridged above. Posterior angles of metathorax strongly produced into sharp, pointed teeth, the lateral angles also projecting angularly. Wings strongly tinged with fuscous; the marginal vein curved, almost closing the cell. Abdomen black, very highly polished, 1½ times as long as the head and thorax together; second segment about two times as long as the remaining ones taken together, coarsely striate on its basal two-fifths. Legs, including coxæ pallid yellow, the posterior coxæ rugose.

Aside from its punctate body, this species may be distinguished from *C. melanocerus* Ashm. by its acute metathoracic angles; from *C. pedalis* Ashm. by its dark wings, and from *C. glaber* by the length of the antennal joints.

SCELIONIDÆ.

Telenomus heracleicola sp. nov.

Female. Length 1.25 mm. Black; legs yellowish red, with black coxæ; antennal scape yellowish at base; mandibles except tip and palpi, yellow. Head two and one-half times as wide as long, the front highly polished medially, on the sides shagreened; hollowed out just above the antennæ, the depression divided by a short median carina; vertex shagreened. Eyes very faintly pubescent. Antennæ rather slender, the flagellum almost two times the length of the scape. Pedicel narrowed at base, at the tip wider than the first flagellar joint; first flagellar one and one-third times the length of the pedicel and one and one-half times as long as the second; third and fourth moniliform. Club five-jointed, the three middle joints largest, quadrate, last joint scarcely longer than the penultimate. Thorax oval, the mesonotum finely punctate, dull, sparsely pruinose. Abdomen as long as the thorax, first segment coarsely fluted; second striate at the base, about one and one-half times as long as wide, following segments very small. Legs yellowish red, the coxæ black. Wings hyaline, marginal vein about two-thirds the length of the stigmal. Post-marginal somewhat less than two times the length of the stigmal.

Male. Similar, but the antennæ are filiform, the flagellum two and one-half times the length of the scape, the pedicel two-thirds the length of the first flagellar joint, the second flagellar about one-third longer than the first; fourth and following decreasing, the last equal to the pedicel.

Described from four females and one male sent me by my friend Professor A. L. Melander. He tells me that they were reared from butterfly eggs collected on a species of *Heracleum,* at Pullman, Washington.

Macroteleia kiefferi n. nov.

Macroteleia rufipes Kieffer, Berliner Entom. Zeit. Vol. 50, p. 264 (1905), nec Cameron, Invertebrata Pacifica, Vol. 1, p. 52 (1904).

By a queer coincidence Kieffer described this species from Nicaragua as *rufipes*, overlooking Cameron's description of *rufipes*, which is also from Nicaragua, both species having been collected by Professor Baker.

The two are apparently distinct, *kiefferi* differing by the quadrate joints of the antennal club, which are plainly transverse in *rufipes*. The latter species also has a longer abdomen.

Sparaison graenicheri sp. nov.

Female. Length 4.5 mm. Black, coarsely rugose, but still rather shining; tibiæ and tarsi reddish. Head seen from above as wide as long, the frontal ledge on the same plane as the vertex with a broad sulcus along its anterior margin. Surface of head very coarsely rugose-punctate, the under side of the ledge transversely arcuately striated. Mandibles and palpi black. Antennæ black, scape much swollen at the tip below, slender at the base, about four times as long as the pedicel, the latter two-thirds the length of the first flagellar joint; second to seventh flagellar joints about equal, quadrate, or slightly transverse, the second narrower at the base; eighth, ninth and apical joints of equal length but growing narrower. Collar and mesonotum sparsely and deeply punctate, shining, parapsidal furrows indicated only by a series of more or less separated punctures, the scapulæ with a slight, weakly defined groove. Scutellum about two times as wide as long, coarsely confluently punctate, except for a median smooth space. Post-scutellum longitudinally spined. Metathorax emarginate behind, the posterior angles distinct but not much produced; its upper face with a series of six longitudinal carinæ. Abdomen elongate oval, almost as long as the head and thorax together; strongly longitudinally striate, the tip punctate. Venter shining, coarsely and sparsely punctate, the sutures crenulate. First segment wider than long; second to sixth decreasing in length; seventh rounded at the tip. Legs black, whitish hairy; anterior tarsi and tibiæ reddish, the latter strongly spinous; posterior tibiæ and tarsi fuscous or piceous. Wings strongly infuscated, the submarginal vein not united with the stigma; postmarginal ill-defined, as long as the thin, curved and knobbed stigmal; radial nervure indicated except at the tip.

This species is characterized by its short, broad frontal ledge, punctate scapulæ, short flagellar joints, metathoracic sculpture and rugose head.

I have a single specimen from Milwaukee, Wis., July 27, 1906. It was collected by my friend Dr. S. Graenicher, after whom I take great pleasure in dedicating the species.

Pantoclis nicaraguana n. nov.

Pantoclis rufipes, Kieffer, Berliner Entom. Zeit., Vol. 50, p. 278, (1905), nec Szepligeti, Zichn. Ergebn., II, p. 157.

DIAPRIIDÆ.

Galesus Curtis.

Ten species of this genus have been recognized as occurring in North America, including the one described here as new. They may be recognized by the following table.

NORTH AMERICAN SPECIES OF GALESUS.

1. Sides of the vertex cornuted, or furnished with angled prominences 2

Head not cornuted above the antennæ, head only a little longer than wide .... **floridanus** Ashmead

2. Antennal prominence emarginated medially between the antennæ 3

Antennal prominence rounded, not emarginate 8

3. Coxæ black 4

Coxæ pale or reddish; antennal scape black, flagellum more or less reddish, middle lobe of thorax with a fovea posteriorly. **politus** Say

4. Abdominal petiole longitudinally grooved or fluted above 5

Abdominal petiole rugose above with a median carina, antennæ of female rufous, legs ferruginous, wings not emarginate at apex .... **autumnalis** sp. nov.

5. Antennæ in part reddish or rufous, wings not or scarcely emarginate at the tip 6

Antennæ entirely black, wings deeply emarginate at apex **atricornis** Ashmead

6. Head but little longer than wide, legs rufous, middle flagellar joints not longer than wide.................. **pilosus** Ashmead
Head much longer than wide, legs honey-yellow or reddish.... 7
7. First flagellar joint longer than the second, median sulcus on second abdominal segment much longer than the lateral ones.................................... **texanus** Ashmead
First flagellar joint much shorter than the second, second abdominal segment with three short sulci at the base **viereckii** Brues
8. Antennæ black 9
Antennæ brown, frontal prominence with a broad diamond-shaped fovea above scapulæ sulcate near the tegulæ........ **quebecensis** Provancher
9. First flagellar joint of male only ½ as long as the pedicel or the second flagellar joint.................. **microtomus** Kieffer
First flagellar joint at least as long as the pedicel or the second flagellar joint .... **clarimontis** Kieffer

Galesus autumnalis sp. nov.

Female. Length 2.5 mm. Shining black, impunctate. Antennæ rufous, darker at the tips; legs ferruginous, the coxæ black. Head polished, about two times as long as wide. Vertex anteriorly deeply sulcate, with two tuberculous teeth on each side. Antennal prominence deeply emarginated so that it appears bilobed; its margin translucent brown. Face on each side of a median raised portion concave; mandibles ferruginous, black at the tips; posterior margin of cheeks arcuately concave. Antennæ reaching to the base of the metathorax; 12-jointed, moderately clavate, rufous except the club, which is piceous. Scape very strongly angulated below just beyond the middle. Pedicel thick, not quite twice as wide as long; first flagellar joint nearly as long as the pedicel, but more slender; second, third, and fourth moniliform; fifth to ninth widening, the fifth quadrate moniliform; sixth transverse moniliform; seventh one-half wider than long; eighth transverse moniliform; ninth quadrate moniliform; tenth ovate, as long as the two preceding taken together; these last three of equal thickness. Mesonotum with the furrows wide apart behind and divergent, not reaching the anterior margin; scapulæ not grooved. Scutellum as wide as long, with two large, oblique, almost confluent foveæ at the base; with a punctate margin. Metathorax short, rugose, with a Λ-shaped carina above. Abdomen not quite as long as the head and thorax together, the petiole twice as long as the hind coxæ; irregularly striate on the sides; above with an enclosed rugose space traversed by a delicate median longitudinal carina. Second segment at the base with a median sulcus as long as the petiole and a short lateral one on each side; following segments smooth, impunctate, scarcely projecting beyond the second. Wings yellowish-hyaline, not emarginated at the tip. Legs ferruginous, stout, the coxæ black.

Described from a female collected by the writer at Fox Point, Milwaukee Co., Wis., October 27, 1906.

The sculpture of the petiole will serve to distinguish the species. It seems to be more closely related to the European *G. rufipes* Thoms, than to any North American species.

Public Museum, Milwaukee, October 16, 1906.

ON THE HABITS AND LIFE-HISTORY OF LEUCOSPIS AFFINIS (SAY). A PARASITE OF BEES.

BY S. GRAENICHER.

J. H. Fabre (1) has presented us with a very detailed account of the habits of the European *Leucospis gigas*, a parasite of two species of mason-bees of the genus *Chalicodoma*, and further on I shall compare his results with those obtained from a study of our species, *L. affinis*.

My first acquaintance with the larva of *Leucospis affinis*, a Chalcidid parasite of bees of the genus *Osmia* was made from a nest of *Osmia pumila* Cr., collected at Cedar Lake, Washington Co., Wis., September 27, 1903. The nest was situated in a dead branch of an elder, and contained two cells placed longitudinally. One of the cells contained a male specimen of the bee ready to leave the nest, but still enclosed within its cocoon. It may be stated in this respect that in this, as well as in the two additional species of *Osmia* to be considered in this paper (*O. atriventris* Rob. and *O. simillima* Sm.) the bees reach the imago-stage in the fall, but pass the winter inside of their cocoons, and leave the nest in the spring. The same has been reported for several species of *Osmia* of Europe, the habits of which are known.

The second cell of the nest of *Osmia pumila* under consideration harbored a full-grown larva of the parasite *Leucospis affinis* inside of a cocoon (spun by the Osmia-larva), and this pupated on May 28th of the following year, and made its appearance as an imago on June 27th.

In an additional nest of the same species from the same locality found in the dead stem of a sumac, altogether four cells were present, and three of these were infested by *Leucospis affinis*. At the time the nest was opened (July 31, 1905,) the parasitic larvæ were already fully developed, but they too passed the winter in the larval stage.

From a nest of *Osmia atriventris* in a piece of dry bark (Cedar Lake, July 31, 1905,) two larvæ of this same parasite were obtained.

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1. **J. H. Fabre, Souvenirs entomologiques, Vol. III, pp. 154-177, pp. 212-218.**

On September 18th of the same year I came across a very young larva and an empty egg-shell of *Leucospis affinis* in a nest belonging to a third species of *Osmia, O. simillima.* The larva of the parasite was crawling around on a dead larva of *Osmia,* it did not seem to thrive on this kind of a diet, and died two days later. A cell of another nest of *O. simillima* collected on the same date contained also a dead larva of the bee inside of its cocoon and an egg of the parasite adherent to the inner wall of the cocoon. These two nests of *O. simillima* were found at Milwaukee in small pieces of driftwood lying on the beach of Lake Michigan.

The most valuable information was obtained from a nest of *Osmia atriventris* situated in a broken off dry branch. A specimen of *Leucospis affinis* was observed ovipositing in three different places close together near the end of the branch between 11 A. M. and 12:15 P. M. on July 11th of the present year. On opening the nest two days later it was found to contain three cells of *Osmia* situated about 7 mm. below the upper surface of the branch in the old gallery of a coleopterous larva running longitudinally. These 7 mm. represent the distance the ovipositor of the parasite had to travel through solid wood before reaching the cavity of the cell. In this, and in the other two species of *Osmia* referred to above, a paste consisting of chewed pieces of leaves is made use of in the construction of the partitions between the cells and the plug closing up the outer end of the gallery. In the nest under consideration the plug had a length of 9 mm. and each of the three cells one of 7 mm., giving the entire structure a length of 3 cm.

In each of the cells an egg of the parasite had been deposited, and it is an interesting fact to be recalled further on that while the lowest cell contained a full-grown bee-larva just beginning to spin its cocoon, and the middle cell also a full-grown one, the larva of the uppermost cell had only reached half of its size, and still had a fair amount of food to dispose of.

Mode of oviposition. While in search of a suitable spot for inserting its ovipositor the parasite was observed walking slowly over the branch in the region outside of the *Osmia* nest, palpating the surface with its antennæ, and at the same time moving the abdomen upward and downward. The antennæ alternate in their palpating movements, the one going upwards while the other goes downwards. As soon as a spot has been selected the insect turns its body around in such a manner as to bring the tip of the abdomen just over the point palpated by the tips of the antennæ. Thereupon the ovipositor is brought into action. This has its origin on the lower surface of the abdomen, but is bent up over the back of the latter. Standing high up on its legs the insect bends the tip of its abdomen forward under its body, and by boring movements forces the ovipositor down through the wood. This was done by the insect under observation in three different places corresponding to the three cells of the bee's nest, and in each instance it took about ten minutes to complete the work. After it had got through with all of the cells it spent a considerable time resting on the branch.

The European *Leucospis gigas* has to drive its ovipositor through the hard cement comprising the walls of the nest of the mason-bees *Chalicodoma muraria* and *C. sicula*, and according to Fabre it spends at times three hours before reaching the cavity of the cell.

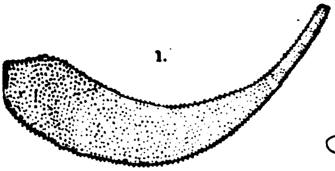
Egg. The slightly curved egg of *Leucospis affinis* (Fig. 1) shows a small knob-shaped tip on the rounded cephalic pole, while the other end is drawn out into a long, slender process. It reaches a length of about 1½ mm., and shows under the microscope an elegant sculpture, due to numerous small papillae covering the egg-membrane. It differs in appearance from the egg of *Leucospis gigas* (Fig. 2) with its hook-shaped slender process as illustrated by Fabre.

Larva. In the larva of *Leucospis* we are dealing with a marked degree of hypermetamorphosis and the conditions met with in the European species *L. gigas* have been considered very thoroughly by Fabre. If the size of the head of the larva before the first moulting, the so-called "primary larva" is correctly represented in Fabre's illustration of the primary larva of *L. gigas* (Fig. 4) then we have in our species *L. affinis* (Fig. 3) a more advanced degree of hypermetamorphosis since the head of the latter is comparatively much larger. In other respects the larvæ of the two species seem to agree pretty closely.

Of the three eggs of *Leucospis affinis* found in the cells of *Osmia atriventris* not one was in contact with the Osmia-larva, every one of them was attached to the wall of the cell.

At 6 A. M. on July 14th a newly hatched primary larva was discovered in one of the cells, at the same time a larva was noticed coming out of a second egg, and at noon a larva appeared from the third egg. These eggs had undoubtedly been deposited on July 11th around noon, and we may therefore estimate the duration of the egg-stage at about 66 to 72 hours. Such an egg is fastened by the tip of its slender process to the wall of the cell or the inner surface of the cocoon, and it protrudes free into the cell-cavity or the cocoon-chamber if the cocoon has already been constructed at the time of oviposition. During the process of hatching the cephalic end of the egg is forced open and lifted up like a lid, and the head of the larva appears. After crawling out the larva still remains clinging to the egg-membrane by means of the enlarged anal segment. In this position it sways its body in different directions, as if trying to gain a hold, and it probably succeeds in sooner or later coming in contact with the body of the bee-larva, since the latter occasionally changes its position. One of these parasitic larvæ was placed on a bee-larva, and it at once secured a hold with its mandibles.

The most conspicuous part of the primary larva of *Leucospis affinis* is the large head with its rather firm covering of chitinous substance. In addition to the head the body consists of thirteen segments adorned with four rows of long, stiff hairs, viz: a lateral row on each side along the lower surface, and one along each side above. Fabre also describes such hairs in the larva of *L. gigas,* and he refers to those along the ventral surface as locomotory organs ("organs ambulatoires"), although he witnessed the curved larva walking around on the bee-larva in a similar manner as a so-called measuring worm (larva of a Geometrid-moth) walks around on its plant. In our species of *Leucospis* we notice the same peculiar movements. At first the head obtains a hold with the mouth parts, and then the curved body is drawn forward, and brings the anal segment near to the head. In turn the anal segment holds fast to the surface, the head is pushed forward for a new hold and in this manner the larva moves over the surface. I can not see any reason for regarding the lower hairs as organs of locomotion as Fabre has done in the case of *L. gigas.* They are probably tactile organs, and furthermore, they may serve the purpose of protecting the small and delicate larva from being crushed between the bee-larva and the surrounding walls.



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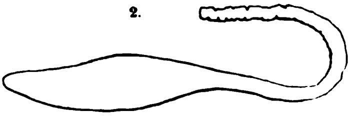

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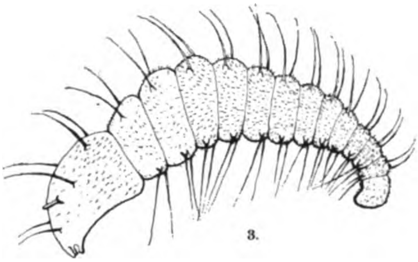

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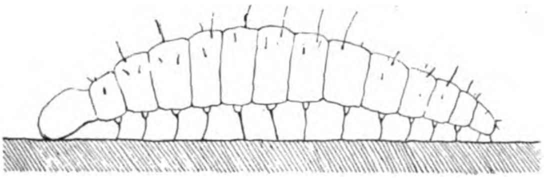

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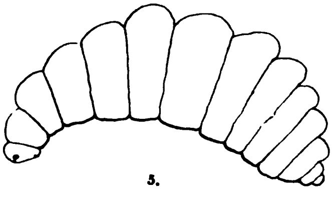

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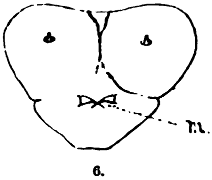

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Fig. 1. Egg of *Leucospis affinis* Say.
Fig. 2. Egg of *Leucospis gigas* Fabr. (after Fabre).
Fig. 3. Primary larva of *Leucospis affinis* Say.
Fig. 4. Primary larva of *Leucospis gigas* Fabr. (after Fabre).
Fig. 5. Full grown secondary larva of *Leucospis affinis* Say.
Fig. 6. Front view of head of secondary larva of *Leucospis affinis* Say.
m Mandibles.

Fabre often found two or three and in one instance even as many as five eggs of *Leucospis gigas* in the same cell of a mason-bee, but never more than one primary larva. He always observed this larva making repeated excursions over the body of the bee-larva, and even around the inner wall of the cocoon, and he was led to believe that these were undertaken for the purpose of destroying any rival egg or eggs that might be present in the same cell. Later on he witnessed the destruction of the remaining eggs by the first-born larva. I have not yet come across more than one egg of *L. affinis* in an Osmia cell, but the number of such cells under observation has been altogether too small. Judging from our acquaintance with several other hymenopterous parasites of bees, as also from the behavior of the primary larva of *L. affinis,* we may feel assured that in this species also more than one egg may be deposited in a single Osmia-cell. The primary larva of this species shows a marked degree of restlessness, and spends most of the time crawling over the Osmia-larva or even leaving the latter and moving around on the wall of the cell or cocoon. We are informed by Fabre that the corresponding trips of *L. gigas* around the wall of the cocoon of the mason-bee are made for the purpose of destroying the rival eggs. The size and strong build of the head in the primary larva of our *L. affinis* seem to me to indicate that such a larva is destined to undertake not only the crushing of harmless eggs, but also the destruction of an equally powerful rival larva. I desired to study the attitude of two such larvæ toward each other, and placed them together with an Osmia-larva in a small glass-tube of the same size as an Osmia-cell. During the day one of the larvæ attacked and killed the other one and sucked its contents, and in the evening nothing was visible of the conquered one but the shrivelled remains. The bee-larva serves as food for one parasite only, and when more than one egg has been laid in a single cell, only one larva issuing therefrom can survive.

The first moult causes some considerable changes in the appearance and behavior of the larva, and in its new form it is called by Fabre a "secondary larva" (Fig. 5). The bulky head is replaced by one smaller in size and with less chitinous covering, the long hairs disappear more or less, and the larva leads a quiet life on top

A REMARKABLE CEREMONIAL OBJECT FROM MICHIGAN.

BY HENRY L. WARD.

The Public Museum has recently purchased a remarkable ceremonial object, found some months ago by Charles Buesch in the bed of a creek about eight miles northwest of Freesoil, Mason Co., Mich.

It is of a type that would be classed in the vernacular as a two-hole gorget, although its real use is, like that of so many ceremonials, merely a matter of conjecture.

The specimen is remarkable both for its shape and size, and when obtained we knew of no other as large, but have since seen figured in a circular advertising Moorhead's forthcoming work on archaeology one that almost duplicates this, both in form and dimensions. Nothing is stated about it except that it is made of cannel coal and was found in Ohio.

The Museum's specimen may be cannel coal, but it is so much weathered that it is difficult to make certain. A minute fragment held in an alcohol flame ignited, giving off a bituminous odor. Before seeing Moorhead's figure I had called the material from which this is made bituminous shale. The distinction is unimportant in this connection.

The surface is so altered as to very closely resemble old wood in color and weight, and the specimen was, I am given to understand, considered to be of that material by some local collectors to whom it was shown. An end had been broken off and cemented before it came to our hands, and from the edges that did not join, the color of the interior is seen to be dull black. The weathering has produced cracks and emphasized the laminated structure which is shown in the drawing. Its original specific gravity has evidently been lowered.

The specimen is 262 mm. (10¼ inches) long, 17mm. (11-16 inch) thick at the center between the perforations. The two surfaces of the ends are nearly parallel, the upper very gradually swelling to meet the connecting shaft; 8 mm. (5-16 inch) fairly represents the average thickness of these wings. The side opposite to that figured is flat, but not in the same plane. The shaft is

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to that figured is flat, but not in the same plane. The shatt is

slightly concave from end to end and the wings turn slightly upwards. A transverse section of the shaft at its center would approximate a semi-circle. The weight of the object is eight ounces.

The inner edges of the holes and a shallow groove connecting them appear to have been worn as by a thong passing from one to the other; but there are no indications of similar wear about the holes upon the opposite side of the object, as might be expected; therefore it is possible that the slope of the inner edges of the holes and the connecting groove were cut by the maker, or else that the thong that presumably passed through the holes was knotted on the opposite side and did not have any movement there.

On the flat side of the object, beginning at what is the upper right hand corner of the figure and running down the outer edge for about an inch and a quarter, are three series of talley lines, one consisting of nine marks, with probably a tenth so worn away as to be uncertain, one of ten, and one of twelve lines, running at an angle of about 45 degrees to the curved border and each subtended by a single line. The members of each series are practically parallel to each other, but the three series stand at angles to one another. There is a hint of another talley following the last of these, or perhaps a continuation of it, but so obliterated as to be quite uncertain.

We are aware that Mr. Gerard Fowke in "Stone Art," 13th Ann. Rept. Bureau of Ethnology, in writing of gorgets and their uses says on page 117: "Some of the specimens have various notches and incised lines, the latter being sometimes in tolerably regular order; but there is not the slightest indication that these marks had any meaning or were intended for any other purpose than to add to the ornamental appearance of the stone."

The general appearance, style of arrangement, fineness and consequent inconspicuousness of these lines and their placement upon a surface which undoubtedly was the back of the gorgit and very likely was hidden from view leads me to incline to the opinion that they represent tallies and not ornamentation.

We can imagine that this object was a symbol that was used in the native ceremonies of long ago, and was either carried fastened to a staff or, more probably, hung about the breast of a participant in an unknown aboriginal procession.

NOTES OF THE FOSSIL FISH-SPINE. PHLYCTAENACANTHUS TELLERI (EASTMAN).

By Edgar E. Teller.

To the specialist and student of palæichthyology the fossil fish remains as found in the Hamilton limestones at Milwaukee, Wisconsin, possess more than ordinary interest. While never found in any great quantity, and then found only in a fragmentary condition, the state of preservation is nevertheless in what we might term a very good condition, and consists entirely of the original external bony plates, spines, scales and teeth, almost all of which are really remarkable. Local collectors for nearly a quarter of a century have from time to time fortunately secured a single specimen or two, until in the aggregate quite a quantity of material of several species has been brought together which, in the hands of one or two specialists, has resulted in bringing to the notice of those interested valuable additions to the known fauna of the period.

In 1898 Dr. C. R. Eastman of the Cambridge Museum of Comparative Anatomy published in the American Naturalist a series of papers describing and figuring several species new to science from this locality. In volume XXXII, No. 380, pp. 550-552 (August, 1898) of that journal, in a continued article on the dentition of devonian Ptyctodontidæ he describes the figures as a new genus and species the spine *Phlyctænacanthus telleri.* We copy a portion of this article as follows:

ASSOCIATED ICHTHYODORULITES.

"Rohon* in his paper on *Ptyctodus* mention the occurrence in the Russian Devonian of dorsal fin-spines belonging to the so-called "Chimæroid type of ichthyodorulites," as defined by Jaekel**.

As no other form with which the remains can be theoretically associated is present in the same horizon, Rohon suggests that both dentition and defenses may have belonged to *Ptyctodus*. The Russian spines are bilaterally symmetrical, triangular in section, slightly curved backwards, and are ornamented with numerous small tubercles, more or less regularly arranged. The posterior face is concave and bears a double series of small denticles.

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*Rohon, J. V. Beitrag zur Kenntniss der Gattung Ptyctodus. Verhandl. Mineral Gesellsch. St. Petersburg, Vol. XXXIII, pp. 1-16 (1895).

**Jaekel, O. Ueber fossile Ichthyodoruliten. Sitzungsber. Gesellsch. naturforsch. Freunde, Berlin. No. 7, p. 123 (1890).

The style of ornamentation of these spines is remarkable, and we are at once struck with the coincidence that in the Hamilton limestone of Milwaukee ichthyodorulites should be found which have a similar tuburculated ornament. Several very choice examples have been obtained by Messrs. Teller and Monroe, one of the most perfect being that reproduced in Fig. 49 (Plate 1, this paper), the property of Mr. Teller.

This spine has a very graceful curvature, and is of comparatively large size, the length of the arc joining the extremities on the anterior margin being 20 cm. The width where it is broken off below, which is not far distant from the beginning of the exerted portion, is 5.5 cm., and the maximum thickness at this point is 5.5 mm. The spine is extremely compressed laterally, both sides being almost flat. There is no strongly marked anterior keel. The posterior face is slightly sulcated, and each side of the sulcus is set with closely approximated tubercles of somewhat larger size than those occurring elsewhere. The bottom of the sulcus is traversed by a faint longitudinal ridge, triangular in section.

The individual stamp imparted to this spine by its flattened, arcuate shape is heightened by its peculiar ornamentation. The lateral faces are beset with numerous small tubercles not having a very definite arrangement, but in some specimens showing a tendency to become parallel to the anterior and posterior margins. One of Mr. Monroe's spines has the tubercles disposed more numerously along a series of parallel grooves, situated some distance apart, the whole presenting a more or less concentric appearance, and indicating successive growth stages in the development of the organ. The appearances indicate that the inserted portion tapered gradually towards the base, but this region itself has not been recognized in any of the specimens thus far examined. Most of the tubercles have been worn down smooth to their bases, or are evenly rounded on top, but a few retain traces of a fine original stellation. One or two spines, instead of having the anterior margin uniformly curved, show a slight angulation at the region of maximum width, in that the spine tapers gradually from this point in both directions, distally and proximally.

Obviously these spines, differing as markedly as they do from the majority of Palæozoic ichthyodorulites, cannot be included under any known genus or species. We therefore propose the new genus *Phlyctœnacanthus* for their reception, and have pleasure in naming the species *P. telleri,* * * *.

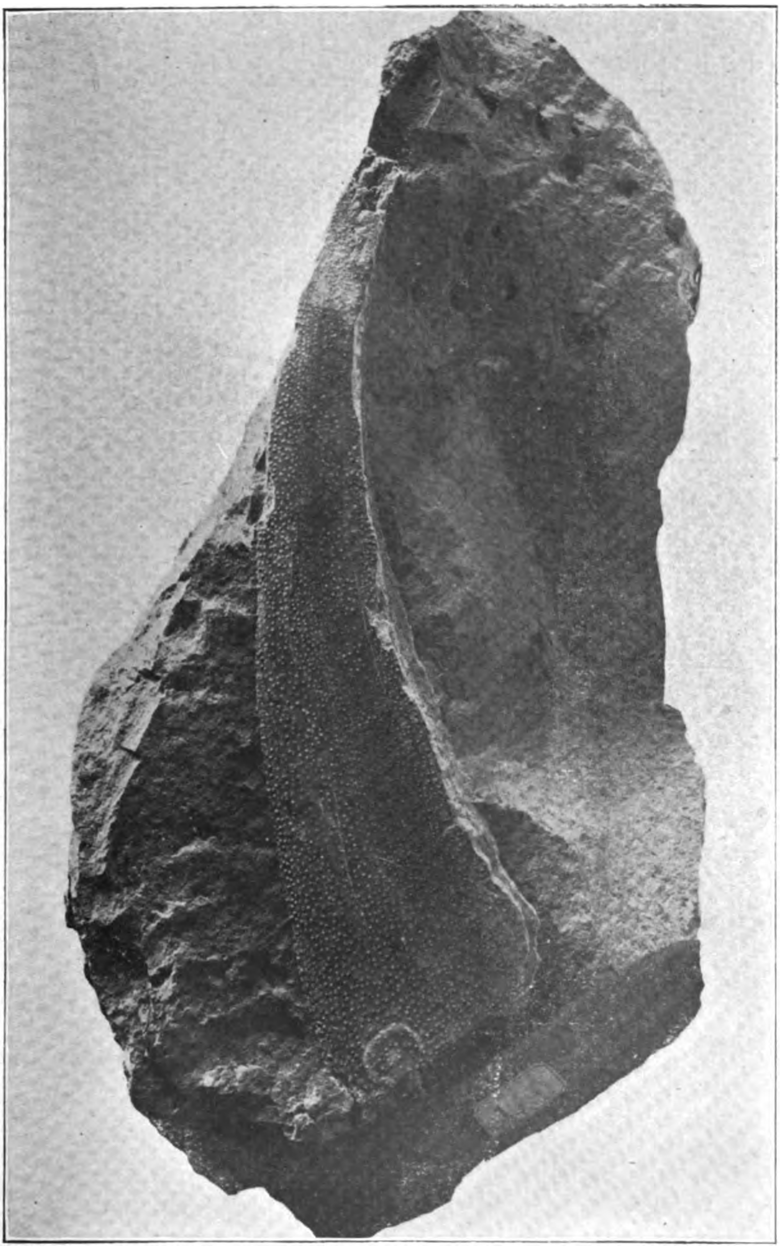
Regarding their affinities, we can only suggest that they may have pertained to *Palœomylus.* Their large size precludes an association with either *Rhynchodus* or *Ptyctodus;* and *Cladodus,* the only other Elasmobranch known to occur in the Wisconsin Hamilton, was in all probability a spineless shark. On the supposition that they were the spines of *Ptyctodus ferox,* then we ought by good rights to have found similar fossils in the Slate Quarry fish beds, where there is such a wonderful concentration of *Ptyctodus* remains. But such spines as have been recovered from the Iowa locality are very different from *Phlyctœnacanthus.* The latter are thus definitely excluded from all known genera occurring at Milwaukee, except *Palœomylus.* But as we know nothing, for instance, of the denition with which *Heteracanthus politus* was associated, so, too, there is as much likelihood of *P. telleri* belonging to some unknown Elasmobranch genus as to *Palœomylus.* But as to the relative probability of one of these "genera" of Milwaukee ichthyodorulites belonging to the *Ptyctodontidœ,* the evidence of the tuberculated Russian fin-spines would go to show that *Phlyctœnacanthus* is the likelier of the two to have its position established here. * * *."

At the time of the writing of that article, but few specimens of the species had been collected, the best one of them being used as the type of the genus and species as described. Since then a few more specimens having been secured that throw more light on its structure, it has been thought proper to reprint that portion of the original description with such other information as we now have from the new material at hand. The difficulty of obtaining anything like perfect specimens at the locality can only be appreciated by those who have collected these, and while the nature of the formation is such as to give the impression that they should be found, as those portions secured are generally in a very good state of preservation, the large quantity of high explosives used in getting out the limestones, which, while fine grained and rather uniformly stratified, break up very irregularly and almost invariably furnish the collector with a quantity of fragments almost impossible to assemble, and in most cases furnish even a poor conception as to what portion of the specimen they should be assigned.

The figure shown on plate I is that of the type specimen. As found the spines are uniformly almost flat on both their right and left faces and of a nearly uniform thickness from the anterior to the posterior margins. The writer, who has been familiar with all of the specimens collected in the past twenty-five years, has never observed but one specimen in any other form, and that one, while showing a strong tendency to be triangular in its section, preserved no indications whatever of a posterior margin. The anterior margin is slightly rounded, and has an irregular arrangement of tubercles down its face to the angle of the spine (Plate 2), below which none have been observed. As noted by Dr. Eastman, the tubercles on the lateral faces are without any regular arrangement, unless in a few cases where the lines of growth are prominent there seems to be a tendency to parallel those lines; the double row of tubercles noted by him on the posterior angle we find to occur only on a small portion of the upper part of the spine, below which we find the angular sulcus as described, but without tubercles, the greatest width of the spine being at the angle on the anterior face which is at or about the bottom line of the type specimen. Plate 2 is that of another specimen in which the angle of the anterior face, the curvature of the upper portion of the spine and that portion below the angle is most beautifully shown. Plate 3 is that of left face of another specimen of the spine from slightly above the angle of the anterior face downwards toward the inserted portion, showing a length very nearly equal to the length of spine above the angle. At the base of this specimen, at about the middle of the left face, we find a line running diagonally towards the posterior face. This we at first supposed to be a fracture of the spine, or, if possible, the line of a vascular canal, and which later proves to be the portion of another spine.

Plates 4 and 5 are those showing the right and left faces of still another specimen, in which is seen not only the base of the inserted portion of the spine, but which shows that it is supported by a second ray of the spine laying directly back of and fitting accurately into the sulcus on the posterior part of the first ray, a fact that was unknown at the time the type was described. The faces of this second ray are covered with tubercles, as is the first ray, and agrees with it in every particular. This second ray of the spine has about the same general thickness of the first ray. The inserted portion terminates in a bulbous end, and penetrated the body of the fish some distance lower than the termination of the first ray, while its distal end was probably approximately acute and terminated at a point about midway between the distal termination of the first ray and a line about even with the angle on the anterior face of that ray. The anterior margin of the second ray should have an angular face to fit into the sulcus noted on the posterior face of the first ray. The markings on the posterior face of the second ray are unknown at this time. This specimen shows the gradual contraction at the base of the right and left faces of the first ray, bringing the base to almost an acute termination. (Dr. Eastman's supposition, that the inserted portion of the spine tapered gradually towards the base is thus proved correct.) The bulbous termination of the second ray and the manner in which it fits against the acute termination of the first ray shows the very strong support given thereby. Both the right and left faces of the two rays show the tubercles peculiar to the species to extend to the extreme ends of the inserted portion, where, however, they are much smaller and rather more numerously disposed than on the exerted portion. Assuming that the specimens that we have secured in the aggregate are of the average size, a reconstruction of a spine from them would show a length of about sixteen and one-half inches from the base of the inserted portion to the apex, a very formidable weapon of either offense or defense, and one that could have belonged only to a fish of very large size.

Associated with the specimen on Plates 4 and 5 is to be seen a fairly well preserved specimen of the fossil tooth *Palæomylus greenei,* the only case we know of in which any portion of a tooth has been found with any of the spines so far collected, and, while there is probably nothing in this association to positively identify



PHLYCTÆNACANTHUS TELLERI EASTMAN.

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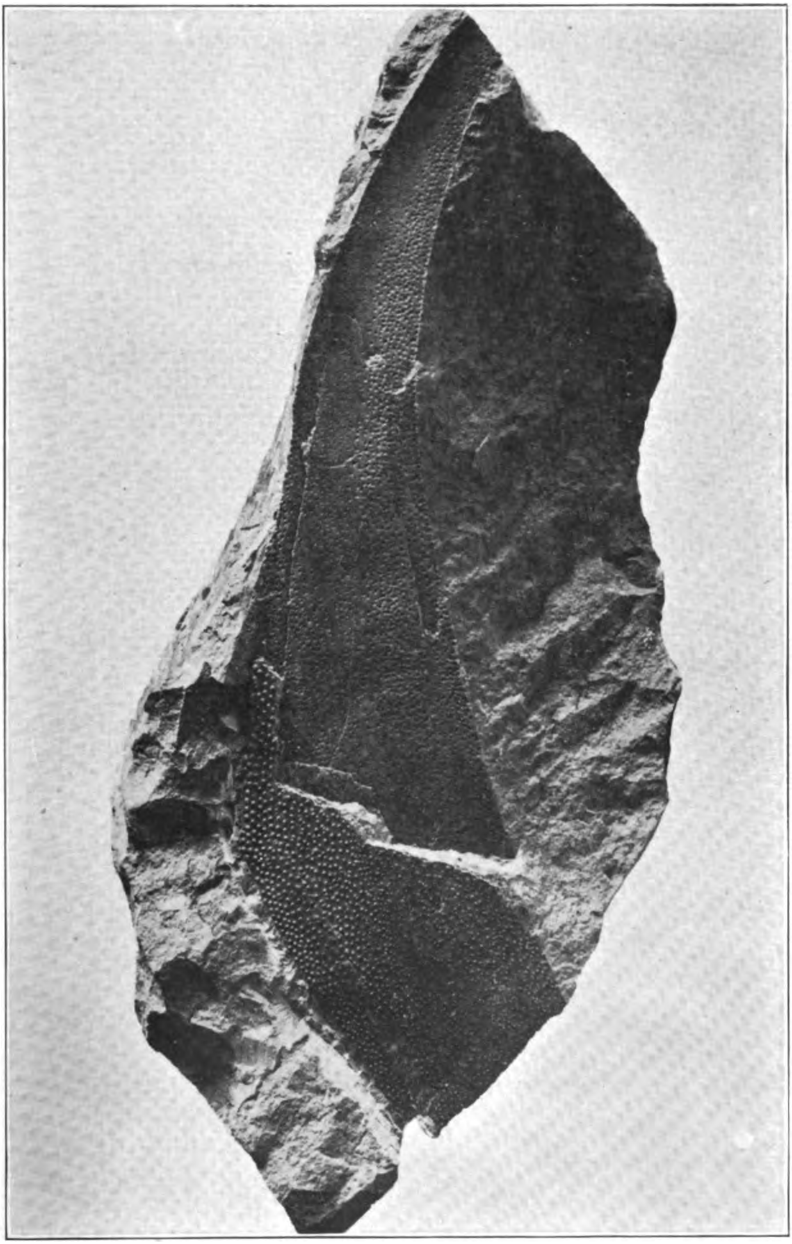

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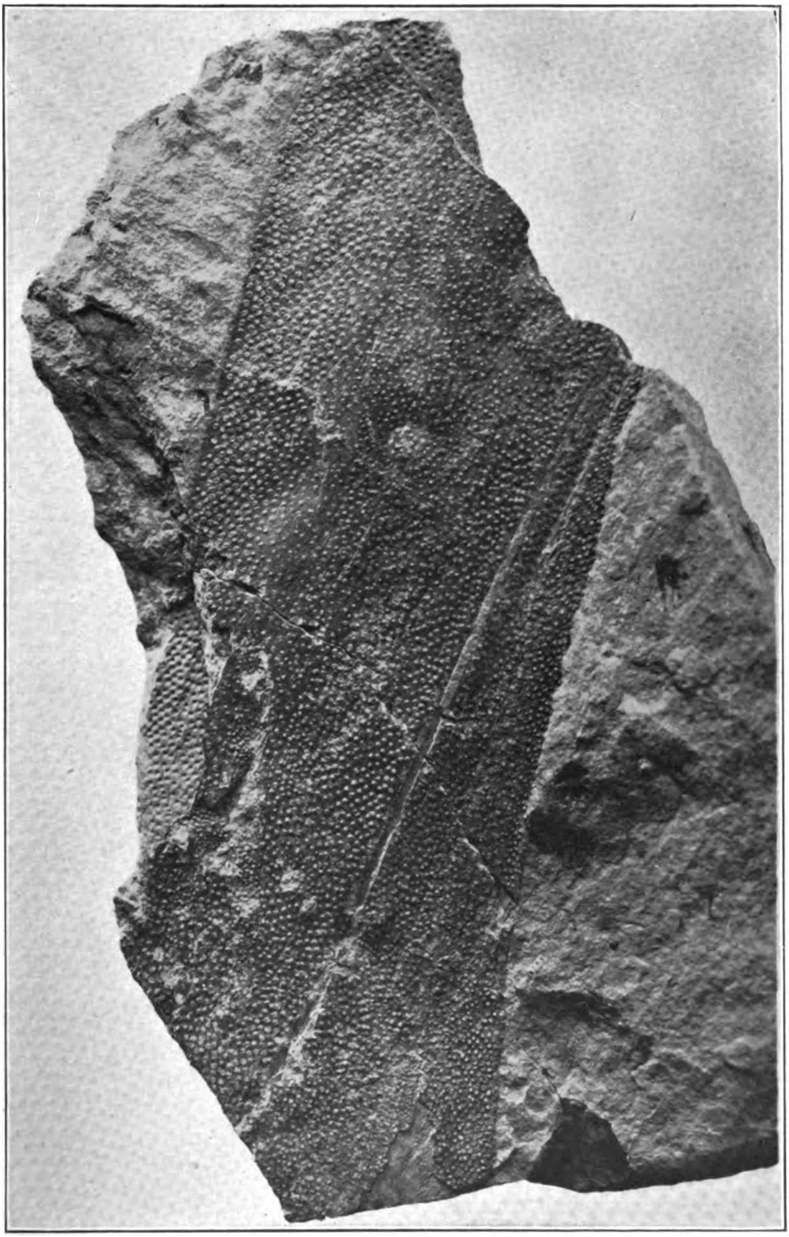

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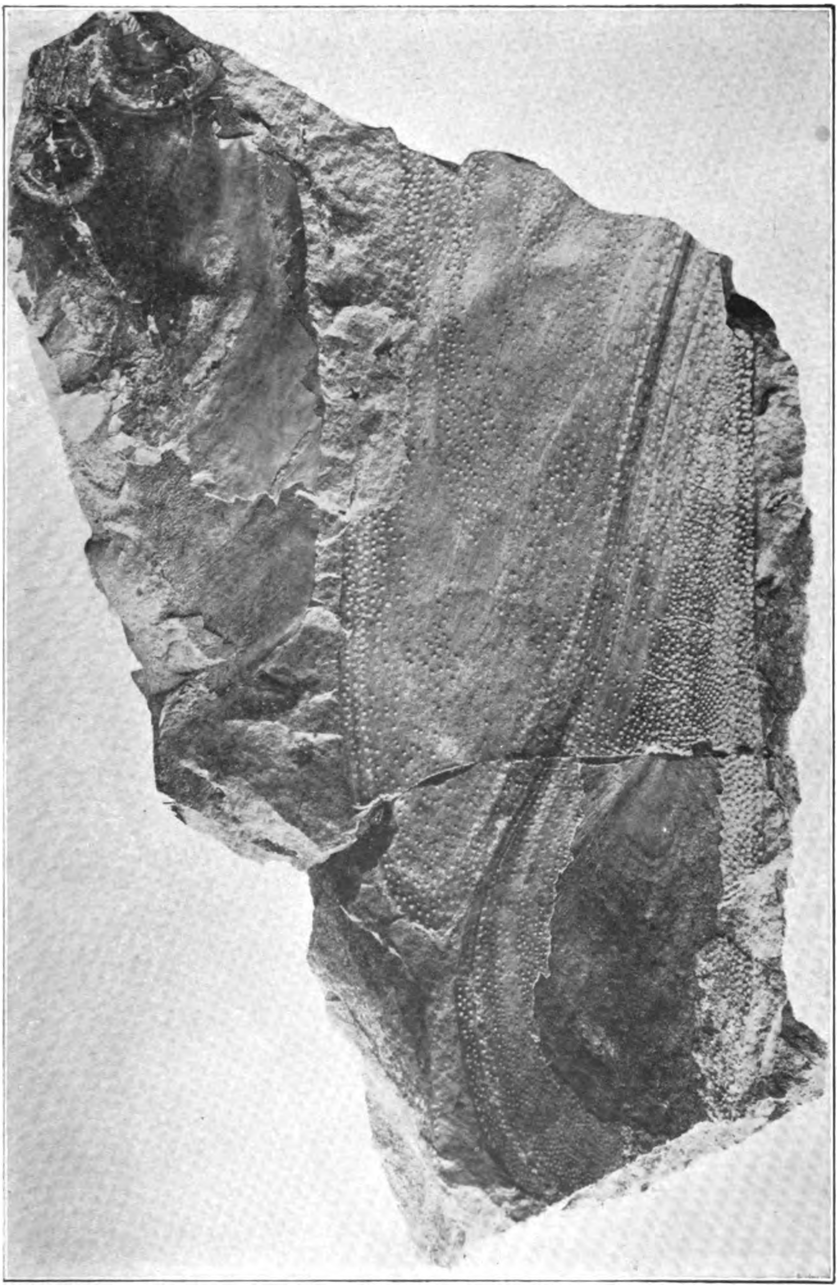

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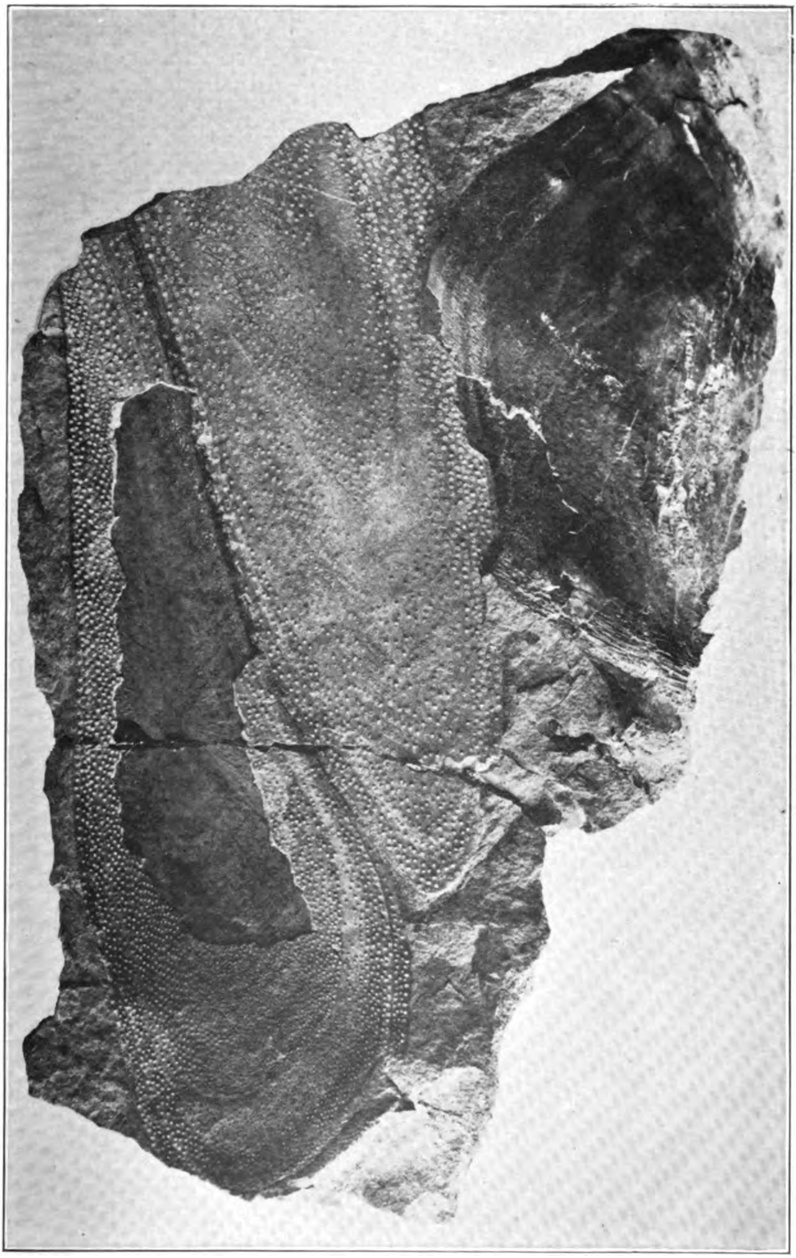

PHLYCTÆNACANTHUS TELLERI Eastman.

FOR EXPLANATION OF PLATE SEE PAGE 167

the tooth and the spine as belonging to the same species, there is the strong supposition that they may. Of the dentition found at the locality but two of them,*Palæomylus* and *Dinichthys,* are of a size that might refer them to a fish that might carry a spine the size of *Phlyctænacanthus.* We have always believed that the spine would prove to be that of *Dinichthys,* from the fact that in one case also it has been found associated with plates of that genus, also that the tubercular markings are characteristic of the latter, and it must therefore remain for still further discovery of the tooth and spine to be found with other fish remains already described, or to be hereafter described, before it can be fully and finally determined to just what genus and species they must be eventually assigned.

All of the specimens figured in this paper were collected from the Hamilton formation at Milwaukee, Wis., by the writer, and are now in his private collection.

Oct. 17th, 1906.

DESCRIPTION OF PLATES.

Phlyctænacantus telleri Eastman.

Plate 1. Type specimen, showing the upper part of the spine.

Plate 2. Another specimen showing the angle of the anterior surface and that portion of the spine above the angle.

Plate 3. Showing the angle and that portion of the spine below the angle and above the inserted portion, also a part of the second ray of the spine.

Plate 4. The right side of a specimen that shows the inserted portion of the two rays, and a portion of the spine below the angle, also the tooth Palæomylus greenei.

Plate 5. The left face of the specimen shown on Plate 4.

All figures two-thirds natural size.

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